LOWER PASSAIC RIVER RESTORATION PROJECT OPERABLE UNIT (OU) 4

Current Conditions Monitoring Program (CCMP)
Draft Quality Assurance Project Plan (QAPP)
For
Chemical Water Column Monitoring/Small Volume Data Collection

USACE Contract No. W912DQ-18-D-3008
Task Order No. F3009, ATP 01

September 3, 2019

Prepared for:
U.S. Army Corps of Engineers
Kansas City District

Prepared by:
CDM Federal Programs (CDM Smith)
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Edison, New Jersey 08837

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Acronyms

ABS	absolute difference
ASC	analytical services coordinator
CCV	continuing calibration verification
CCMP	Current Conditions Monitoring Program
CDM Smith	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CIH	certified industrial hygienist
CLP	contract laboratory program
COC	chain of custody
CPG	Cooperating Parties Group
CRM	certified reference material
CSM	conceptual site model
CVAFS	cold vapor atomic fluorescence spectrometry
CWCM	chemical water column monitoring
DC	data coordinator
DDx	dichlorodiphenyltrichloroethane and its derivatives
DL	detection limit
DOC	dissolved organic carbon
DQA	data quality assessment
DQI	data quality indicator
DQO	data quality objective
DV	data validation
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
FASTAC	Field and Analytical Services Teaming Advisory Committee
FCN	field change notification
FID	flame ionization detector
FS	feasibility study
FTL	field team leader
GC	gas chromatography
H&S	health and safety
HASP	health and safety plan
Hg	mercury
HRGC	high-resolution gas chromatography
HRMS	high-resolution mass spectrometry
ICP-AES	inductively coupled plasma atomic emission spectroscopy
ICP-MS	inductively coupled plasma mass spectroscopy
ID	identification
IPR	initial precision and recovery
IR	infrared
L	liter
LCS	laboratory control sample
LOQ	level of quantitation
LPR	Lower Passaic River
LRMS	low resolution mass spectrometry
LSASD	Laboratory Services and Applied Science Division

MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter
mm	millimeter
MPC	measurement performance criteria
MS	matrix spike
MSD	matrix spike duplicate
NA	not applicable
NELAP	National Environmental Laboratory Accreditation Program
ng	nanogram
NJDEP	New Jersey Department of Environmental Protection
OC	organochlorine
OPR	ongoing precision and recovery
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PAL	project action limit
PCB	polychlorinated biphenyl
PCDD/PCDF	polychlorinated dibenzodioxin/furan
PM	project manager
POC	particulate organic carbon
PQL	project quantitation limit
PQLG	project quantitation limit goal
PQO	project quality objective
PTFE	polytetrafluoroethylene
QA	quality assurance
QAM	quality assurance manager
QAS	quality assurance specialist
QAPP	quality assurance project plan
QC	quality control
QL	quantitation limit
r	correlation coefficient
RPD	relative percent difference
RPM	remedial project manager
RRF	relative response factor
RSCC	regional sample control coordinator
RSD	relative standard deviation
SDG	sample delivery group
SDL	sample detection limit
SIM	selected ion monitoring
SM	standard method
SOP	standard operating procedure
SOW	scope of work
SRM	standard reference material
SSC	suspended solids concentration
SSHO	site health and safety officer
TAL	Target Analyte List
TAT	turnaround time

TBD	to be determined
TDS	total dissolved solids
TM	task manager
TOC	total organic carbon
TSS	total suspended solids
UFP	Uniform Federal Policy
USACE	U.S. Army Corps of Engineers
VER	verification sample
VOC	volatile organic compound
°C	degrees Celsius
%	percent
%D	percent difference
%R	percent recovery
µg/L	micrograms per liter
µm	micrometer

Section 1 Introduction

CDM Federal Programs Corporation (CDM Smith) received task order No. F3009, ATP 01 from the U.S. Army Corps of Engineers, Northwestern Division (USACE) contract No. W912DQ-18-D-3008. CDM Smith has been tasked to support USACE and the U.S. Environmental Protection Agency (EPA) in providing oversight of the Current Conditions Monitoring Program (CCMP) for the Lower Passaic River (LPR) Restoration Project, Operable Unit (OU) 4, New Jersey. This task order involves oversight of the Cooperating Parties Group (CPG) CCMP field investigation, including chemical water column monitoring (CWCM).

This quality assurance project plan (QAPP) has been prepared in accordance with UFP-QAPP manual (EPA 2005) and optimized worksheets (EPA 2012) and is compliant with EPA's QAPP requirements document EPA QA/R-5 (EPA 2001). In addition, this project will be implemented in accordance with the quality procedures in CDM Smith's Quality Manual (2018). This QAPP is the governing document for execution of the oversight task. CDM Smith will use various plans prepared by the CPG contractors to verify proper execution of the CCMP.

The QAPP covers oversight tasks currently assigned to CDM Smith during the CPG's CWCM. Oversight activities related to other components of the CPG's CCMP will be described in future QAPP addenda, as the scope of work and CPG field activities become more defined.

1.1 Site Overview

On May 8, 2007, EPA announced that it had reached agreement with 73 companies considered potentially responsible for contamination in the LPR to undertake a CCMP pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Superfund Amendment and Reauthorization Act. These parties, referred to as the CPG, have retained the consultants de maximis, Inc., Anchor QEA, AECOM, and Ocean Surveys, Inc. to support the CPG's CCMP effort for the lower 17.4 miles of the Passaic River.

In 2014, the CPG and their contractors completed field investigation work required to support the 2007 agreement. In December 2017, the CPG approached EPA, requesting to perform a source control interim action on the upper 9 miles (encompassing river mile 8.3 to the Dundee Dam) of the LPR. Subsequently, in an October 10, 2018 letter, EPA directed the CPG to prepare a streamlined feasibility study (FS) for OU4 of the Diamond Alkali Site. In support of this directive, the CPG will be performing additional investigative work to establish current conditions of the upper 9 miles of LPR OU4.

1.2 Project Information and Path Forward

More than 200 years of industrialization and urbanization have resulted in large impacts to the LPR watershed, which was an important location for industry during the American Industrial Revolution (Malcolm Pirnie 2007). Industrial operations included cotton mills, manufactured gas plants, paper manufacturers, chemical manufacturers, shoemakers, and recycling facilities (Malcolm Pirnie 2007). These industries, as well as other industries developed during the late 19th and early 20th centuries, used

the LPR for process water and waste disposal, which adversely affected water and sediment quality. As a result of these historical factors, sediment and water quality in the LPR are still impaired today.

The CPG-led field investigation is intended to measure concentrations of contaminants of concern in water and conduct additional studies needed for the following reasons: (1) to provide data to calibrate a contaminant fate and transport model; (2) to assess the potential for the recontamination of areas under consideration for remediation; and (3) to establish current conditions to serve as a baseline for tracking future trends during the postconstruction period. The oversight program is designed to provide technical review and evaluation of the CPG-implemented field sampling plan addendum. This oversight QAPP is intended to integrate the technical and quality control (QC) aspects of the oversight program and to provide guidance on 2019 and 2020 field activities associated with a CWCM investigation of the LPR.

This oversight QAPP details the planning processes for conducting field oversight and collecting split samples and describes the implementation of quality assurance (QA) and QC activities developed for this oversight program. The objective of CDM Smith's split sample collection is to verify the accuracy of the CPG's data. When required, this QAPP will be amended as 2019 and 2020 field activities/schedule are further defined.

The oversight described in this QAPP is for CWCM. Oversight will include field observation of the surface water sampling activities and collection of chemical data. Additional oversight activities will include a review of CPG-selected sampling locations (as necessary, oversight staff will communicate with EPA and USACE on sampling locations). As part of this oversight task, CDM Smith will accept surface water split samples for the following analytes:

- Low-level polycyclic aromatic hydrocarbons (PAHs)
- Organochlorine (OC) pesticides (dichlorodiphenyltrichloroethane and its derivatives (DDx) and dieldrin)
- Polychlorinated biphenyl (PCB) congeners and homologs
- Polychlorodibenzodioxins/furans (PCDDs/PCDFs)
- Total and dissolved copper and lead
- Total and dissolved low-level mercury (Hg)
- Dissolved organic carbon (DOC)
- Particulate organic carbon (POC)
- Suspended solids concentration (SSC)

Sampling beyond CWCM will be elaborated on in future QAPP addenda.

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Prepared for: U.S. Army Corps of Engineers

Prepared by: *Michelle Yam*

Date: *September 3, 2019*

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QAPP Worksheets #1 and 2: Title and Approval Page
(UFP-QAPP Manual Section 2.1)
(EPA 2106-G-05 Section 2.2.1)

Contract: USACE Contract No. W912DQ-18-D-3008
Task Order/Operable Unit: Task Order No. F3009, ATP 01 / OU4

CDM Smith Project Manager:
David Marabello Signature_____

CDM Smith QA Manager:
Jo Nell Mullins Signature_____for_____

USACE Project Manager:
Elizabeth Franklin Signature_____

EPA Remedial Project Manager:
Diane Salkie Signature_____

EPA Quality Assurance Officer:
Bill Sy Signature_____

State Regulatory Agency/Stakeholders (name/title/signature/date) (as applicable):
EPA, USACE, New Jersey Department of Environmental Protection (NJDEP), New Jersey Department of Transportation, National Oceanic Atmospheric Administration, U.S. Fish and Wildlife Service

Dates and Titles of Plan and Reports Written for Previous Site Work, if Applicable:
Quality Assurance Project Plan Hydrographic Survey Addendum. December 2018.

Quality Assurance Project Plan, Addendum #13, Chemical Water Column Monitoring Study/Small Volume Collection Water Quality Monitoring for River Mile 10.9 Removal Action. August 2013.

Quality Assurance Project Plan, Addendum #11, Chemical Water Column Monitoring Study/High Volume Chemical Data Collection Program. December 2012.

Quality Assurance Project Plan, Addendum #12, Collection of Background Surface Sediment Samples. October 2012.

Revised Final Quality Assurance Project Plan, Addendum #10, Low Resolution Coring Supplemental Sampling Program. January 2012.

Revised Final Quality Assurance Project Plan, Addendum #8, Chemical Water Column Monitoring Study/Small Volume Chemical Data Collection. November 2011.

Final Quality Assurance Project Plan, Addendum #9, River Mile 10.9 Characterization Study. August 2011.

Final Quality Assurance Project Plan, Addendum #7, Caged Bivalve Survey. May 2011.

Quality Assurance Project Plan, Final Addendum #5, Revision 1, Fish Tissue Analysis. August 2010.

Quality Assurance Project Plan, Addendum #6, Habitat Identification Survey. July 2010.

Quality Assurance Project Plan, Final Addendum #1, Avian Community Survey. July 2010.

Quality Assurance Project Plan, Final Addendum #4, Surface Sediment Samples Co-located with small Forage Fish Tissue Samples – Collected in Conjunction with Summer 2010 Benthic Community Survey. July 2010.

Final Quality Assurance Project Plan, Addendum #2, Late Spring/Early Summer 2010 Fish Community Survey. June 2010.

Quality Assurance Project Plan, Final Addendum #3, Spring and Summer 2010 Benthic Invertebrate Community Surveys. June 2010.

Final Quality Assurance Project Plan for Physical Water Column Monitoring and Generic Information for Upcoming Tasks. March 2010.

Required QAPP elements and required information that are not applicable (NA) to the project, and an explanation for their exclusions:
This is an oversight project; therefore, the CPG's contractors will collect the samples, perform health and safety monitoring, and have responsibility for equipment calibration, inspection, and maintenance. CDM Smith will monitor field activities, receive split samples, and prepare split samples for shipment.

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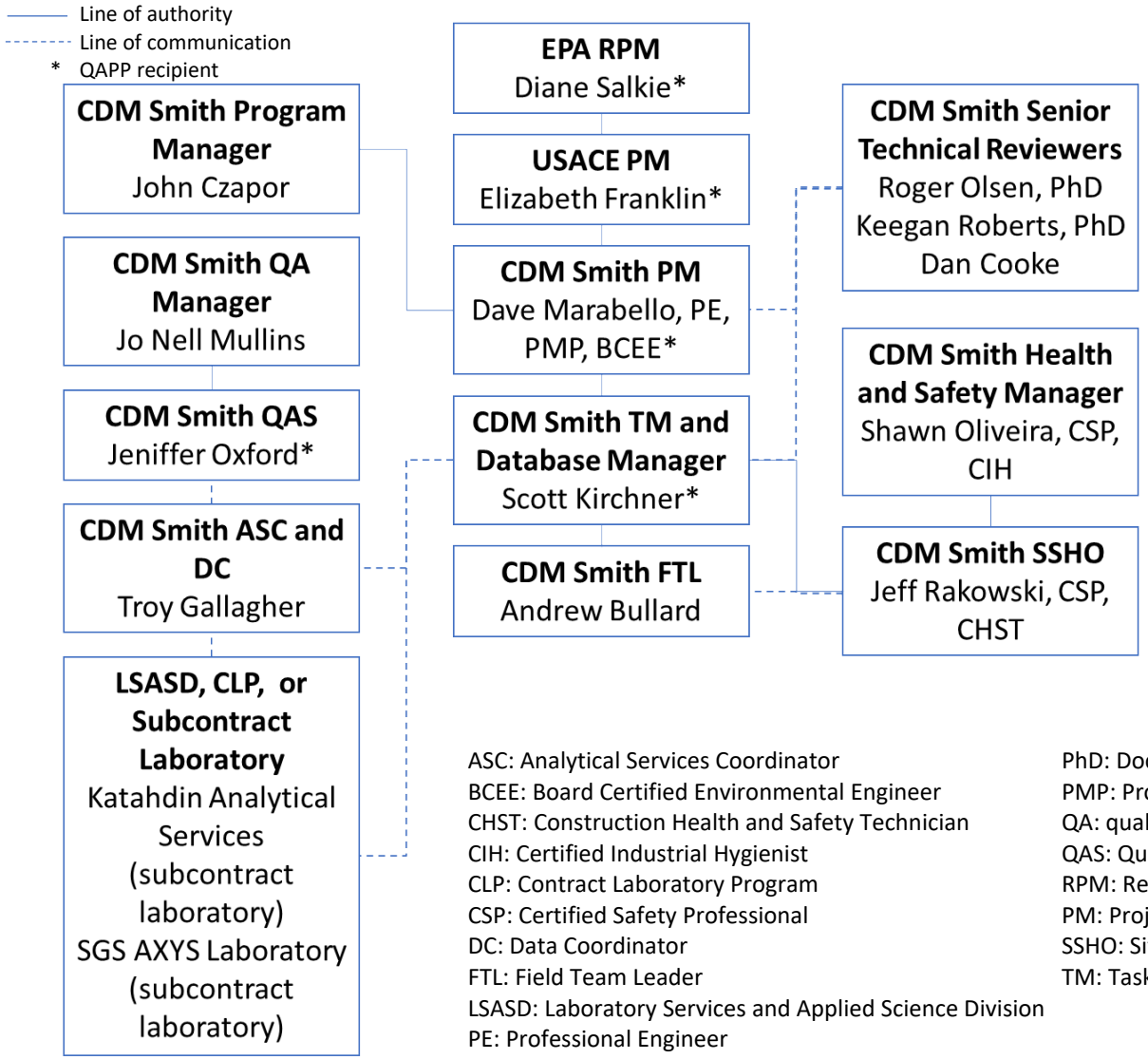
QAPP CROSSWALK
Identifying Information

Optimized UFP-QAPP Worksheets		**2106-G-05 QAPP Guidance Section**	
1 & 2	Title and Approval Page	2.2.1	Title, Version, and Approval/Sign-Off
3 & 5	Project Organization and QAPP Distribution	2.2.3	Distribution List
		2.2.4	Project Organization and Schedule
4, 7 & 8	Personnel Qualifications and Sign-off Sheet	2.2.1	Title, Version, and Approval/Sign-Off
		2.2.7	Special Training Requirements and Certification
6	Communication Pathways	2.2.4	Project Organization and Schedule
9	Project Planning Session Summary	2.2.5	Project Background, Overview, and Intended Use of Data
10	Conceptual Site Model	2.2.5	Project Background, Overview, and Intended Use of Data
11	Project/Data Quality Objectives	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
12	Measurement Performance Criteria	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
13	Secondary Data Uses and Limitations	Chapter 3	QAPP Elements for Evaluating Existing Data
14 & 16	Project Tasks & Schedule	2.2.4	Project Organization and Schedule
15	Project Action Limits and Laboratory-Specific Detection / Quantitation Limits	2.2.6	Data/Project Quality Objectives and Measurement Performance Criteria
17	Sampling Design and Rationale	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
18	Sampling Locations and Methods	2.3.1	Sample Collection Procedure, Experimental Design, and Sampling Tasks
		2.3.2	Sampling Procedures and Requirements
19 & 30	Sample Containers, Preservation, and Hold Times	2.3.2	Sampling Procedures and Requirements
20	Field QC	2.3.5	Quality Control Requirements
21	Field SOPs	2.3.2	Sampling Procedures and Requirements
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
23	Analytical SOPs	2.3.4	Analytical Methods Requirements and Task Description
24	Analytical Instrument Calibration	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables

QAPP CROSSWALK
Identifying Information

Optimized UFP-QAPP Worksheets		**2106-G-05 QAPP Guidance Section**	
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	2.3.6	Instrument/Equipment Testing, Calibration and Maintenance Requirements, Supplies and Consumables
26 & 27	Sample Handling, Custody, and Disposal	2.3.3	Sample Handling, Custody Procedures, and Documentation
28	Analytical Quality Control and Corrective Action	2.3.5	Quality Control Requirements
29	Project Documents and Records	2.2.8	Documentation and Records Requirements
31, 32 & 33	Assessments and Corrective Action	2.4	Assessments and Data Review
		2.5.5	Reports to Management
34	Data Verification and Validation Inputs	2.5.1	Data Verification and Validation Targets and Methods
35	Data Verification Procedures	2.5.1	Data Verification and Validation Targets and Methods
36	Data Validation Procedures	2.5.1	Data Verification and Validation Targets and Methods
37	Data Usability Assessment	2.5.2	Quantitative and Qualitative Evaluations of Usability
		2.5.3	Potential Limitations on Data Interpretation
		2.5.4	Reconciliation with Project Requirements

QAPP Worksheet #3 & 5: Project Organization and QAPP Distribution
(UFP-QAPP Manual Section 2.3 and 2.4)
(EPA 2106-G-05 Section 2.2.3 and 2.2.4)



ASC: Analytical Services Coordinator
BCEE: Board Certified Environmental Engineer
CHST: Construction Health and Safety Technician
CIH: Certified Industrial Hygienist
CLP: Contract Laboratory Program
CSP: Certified Safety Professional
DC: Data Coordinator
FTL: Field Team Leader
LSASD: Laboratory Services and Applied Science Division
PE: Professional Engineer
PhD: Doctor of Philosophy
PMP: Project Management Professional
QA: quality assurance
QAS: Quality Assurance Specialist
RPM: Remedial Project Manager
PM: Project Manager
SSHO: Site Safety and Health Officer
TM: Task Manager

QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet
(UFP-QAPP Manual Sections 2.3.2 – 2.3.4)
(EPA 2106-G-05 Section 2.2.1 and 2.2.7)

ORGANIZATION: CDM Smith

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date[2]
Shawn Oliveira	**Health and Safety Manager** – Oversees adherence to health and safety requirements	M.S. Environmental Engineering; B.S. Chemistry 21 years of experience	CSP, CIH	
Jeff Rakowski	**SSHO** – Manages health and safety requirements at the site	B.S., Geography 13 years of experience	CSP, CHST	
Troy Gallagher	**ASC** – Coordinates with EPA Regional Sample Control Coordinator (RSCC), LSASD laboratory, and subcontract laboratories **DC** – Facilitates field investigation data review and upload	B.S., Chemistry 4 years of experience		
Jo Nell Mullins	**QAM** – Develops and implements the CDM Smith QA program and assesses the implementation of the quality requirements for all projects	M.S., Environmental Health B.S., Biology/Chemistry 15 years of experience	American Society for Quality (ASQ) Certified Quality Auditor; ISO 14001 Lead Auditor Certified; Nuclear Quality Assurance-1 Lead Auditor Certified	

QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet
(UFP-QAPP Manual Sections 2.3.2 – 2.3.4)
(EPA 2106-G-05 Section 2.2.1 and 2.2.7)

ORGANIZATION: CDM Smith (continued)

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date[2]
Jeniffer Oxford	**QAS** – Oversees adherence to project QA requirements	B.S., Natural Sciences; 30 years of experience		
David Marabello	**PM** – Oversees project and responds to EPA Remedial Project Manager (RPM) and USACE PM; manages subcontractors	M.S., Environmental Engineering; B.S., Chemical Engineering; 30 years of experience	P.E., PMP, BCEE	
Scott Kirchner	**TM** – Oversees the field oversight activities; provides guidance on the sampling and field program; analyzes the data; and has responsibility for implementing the field activities and other tasks as applicable to project **Database Manager** – Oversees data management; coordinates with validation staff	B.S., Chemistry; B.S., Environmental Science; 27 years of experience		
Andrew Bullard	**FTL** – Oversees all field investigation activities	M.E.M., Environmental Management; B.S., Environmental Science; 22 years of experience	PMP; trained in EPA sampling methods and field testing procedures	

QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet
(UFP-QAPP Manual Sections 2.3.2 – 2.3.4)
(EPA 2106-G-05 Section 2.2.1 and 2.2.7)

ORGANIZATION: EPA[2]

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date[1]
Diane Salkie	RPM	NA	NA	

ORGANIZATION: USACE[2]

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date[1]
Elizabeth Franklin	PM	NA	NA	

ORGANIZATION: Laboratories

Name	Project Title/Role	Education/Experience	Specialized Training/Certifications	Signature/Date[1]
EPA CLP Laboratory[3] – to be determined (TBD)	QA Officer	TBD (Experience vetted by accreditation body)	National Environmental Laboratory Accreditation Program (NELAP)/EPA CLP	
LSASD – Sumy Cherukara	QA Officer	TBD (Experience vetted by accreditation body)	NELAP/Trained in EPA and standard analytical methods	
SGS AXYS Laboratory – TBD	QA Officer	TBD (Experience vetted by accreditation body)	NELAP	
Katahdin Analytical Services – Leslie Dimond	QA Officer	TBD (Experience vetted by accreditation body)	NELAP	

Notes:
1. Signatures indicate personnel have read and agree to implement this QAPP as written.
2. EPA headquarters staff reviews and maintains the résumés of education and experience for key laboratory staff. This information is not available for the QAPP.
3. A CLP Laboratory is not used for CWCM but may be included in future QAPP addenda.

QAPP Worksheet #6: Communication Pathways
(UFP-QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4)

Communication Driver	Organization	Name	Contact Information	Procedure (Timing, Pathways, Documentation, etc.)
Regulatory agency interface	CDM Smith PM	David Marabello	(732) 590-4691	The CDM Smith PM will send all information about the project to the EPA RPM and the USACE PM. Field changes will be discussed with the EPA RPM and the USACE PM prior to implementation.
Manage field tasks	CDM Smith TM	Scott Kirchner	(732) 590-4677	Act as liaison to CDM Smith PM concerning investigation activities. Daily communication with project team and CDM Smith PM. Communicate implementation issues to FTL.
QAPP changes: In the field Prior to field work During project execution	CDM Smith FTL	Andrew Bullard	(610) 263-2613	Notify TM immediately and promptly complete a Field Change Notification (FCN) form and/or corrected worksheets. Send FCN forms to the QAS.
	CDM Smith PM or TM	David Marabello or Scott Kirchner	(732) 590-4691 (732) 590-4677	Notify EPA RPM, PM, and ASC of delays or changes to field work. Prepare QAPP addendums or revisions in consultation with the client.
Field corrective actions	CDM Smith FTL	Andrew Bullard	(610) 263-2613	FTL will oversee implementation of corrective action and notify PM and TM by email. Task leader will complete the corrective action report form.
Field progress reports	CDM Smith FTL	Andrew Bullard	(610) 263-2613	Complete daily and submit to PM and TM. PM will forward to EPA RPM upon request.
Booking of analytical services	CDM Smith FTL	Andrew Bullard	(610) 263-2613	Submit request to ASC before the time frame below.
	CDM Smith ASC	Troy Gallagher	(212) 377-4514	LSASD analytical services through RSCC 6 weeks prior to sampling for special requests and 3 weeks for routine services.
Facilitate database setup and data management planning	CDM Smith FTL	Andrew Bullard	(610) 263-2613	Provide sample and analytical information prior to sample collection. Provide information on sample and analytical reporting groups and types of report tables required for project.
Facilitate data management	CDM Smith DC	Troy Gallagher	(212) 377-4514	Notify laboratory via email of incomplete or errors in data package or electronic data deliverables (EDDs). Provide data, sample identification (ID), locations, and analyses. Transmit completed sample tracking information to data manager by the completion of each sampling case.

QAPP Worksheet #6: Communication Pathways
(UFP-QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4)

Communication Driver	Organization	Name	Contact Information	Procedure (Timing, Pathways, Documentation, etc.)
Incomplete EDDs or other EDD issues	CDM Smith data manager, TM, or DC	Scott Kirchner Troy Gallagher	(732) 590-4677 (212) 377-4514	Personnel will request resubmittal of corrected EDD by email.
Data verification issues, e.g., incomplete records	CDM Smith FTL and DC	Andrew Bullard Troy Gallagher	(610) 263-2613 (212) 377-4514	DC will send an email to the FTL when an issue is found. FTL will address questions or any discrepancies and notify DC of known changes.
Field corrective action	CDM Smith QAS, auditor, TM, FTL, and field team	Jeniffer Oxford	(212) 377-4536	PM, TM, and FTL will identify corrective actions. FTL initiates corrective action on identified field issues immediately or within QAM-recommended time frame.
Procurement of analytical services	CDM Smith FTL/ASC	Andrew Bullard Troy Gallagher	(610) 263-2613 (212) 377-4514	FTL or task leader will prepare laboratory request; ASC will review and send email to RSCC. If needed, the ASC will prepare an analytical statement of work (SOW) and submit for project chemist review. FTL initiates laboratory kickoff call with subcontract laboratories and emails agenda.
Analytical services support	CDM Smith ASC	Troy Gallagher	(212) 377-4514	Act as liaison with RSCC for CLP laboratories (if used in QAPP addenda), with Ness Tirol for LSASD, and with subcontract laboratories.
Laboratory QC variances and analytical corrective actions	Laboratory PM or QC Officer	TBD		Daily communication with the laboratory staff and regular communication with ASC, QAC, or designee. Provide oversight and direction on technical issues as needed.
Notification of analytical issues; sample receipt variances	CDM Smith ASC	Troy Gallagher	(212) 377-4514	Notify FTL of any sample collection/shipment issues. Notify RSCC, subcontract laboratories to initiate corrective action.
Data validation (DV) findings, e.g., noncompliance with procedures; data review corrective actions	CDM Smith data validator or data assessor	Scott Kirchner	(732) 590-4677	Submit a list of questions or issues to EPA or the subcontract laboratory as appropriate for correction or other appropriate response.

QAPP Worksheet #6: Communication Pathways
(UFP-QAPP Manual Section 2.4.2)
(EPA 2106-G-05 Section 2.2.4)

Communication Driver	Organization	Name	Contact Information	Procedure (Timing, Pathways, Documentation, etc.)
Reporting of issues relating to analytical data quality (including ability to meet reporting limits and usability of data)	CDM Smith ASC or data specialist	Troy Gallagher or Rebecca Farmer	(212) 377-4514 (703) 691-6578	ASC will inform PM and TM via email as appropriate. Data specialist will email ASC with any issues identified with EDDs.
	CDM Smith data manager and data assessor	Scott Kirchner and Vanessa Macwan	(732) 590-4610 (732) 590-4706	Communicate via email to PM and TM as appropriate. Document situation and effect in a data quality report prepared prior to preparing the oversight report.
Release of analytical data	CDM Smith ASC	Troy Gallagher	(212) 377-4514	Receive and review data packages for completeness before data is validated and uploaded to database. Initiate DV of subcontract laboratory data and provide notification to project team when data manager releases data for use.
Site health and safety issues; stop work due to safety issues	CDM Smith SHSO	Jeff Rakowski	(732) 590-4665	Make decisions regarding health and safety issues and upgrading personal protective equipment. Communicate to PM, TM, Health and Safety Manager, and field staff as appropriate.

QAPP Worksheet #9: Project Planning Session Summary
(UFP-QAPP Manual Section 2.5.1 and Figures 9-12)
(EPA 2106-G-05 Section 2.2.5)

Projected Date(s) of Sampling: Summer/Fall 2019 **CDM Smith Site Manager:** David Marabello	**Site Name:** Diamond Alkali OU4 **Site Location:** LPRSA
Date of Planning Session: 4/11/19	
Scoping Session Purpose: CPG presented its proposal for the Current Conditions Monitoring to EPA/Partner Agencies	

Name	Affiliation	E-mail Address
USEPA Team		
Michael Sivak	EPA	Sivak.michael@epa.gov
Diane Salkie	EPA	salkie.diane@epa.gov
Chuck Nace	EPA	Nace.Charles@epa.gov
Beth Franklin	USACE	Elizabeth.A.Franklin@usace.army.mil
Andrew Bullard	CDM Smith	bullardak@cdmsmith.com
Jonathan Clough	Warren Pinnacle	jclough@warrenpinnacle.com
Dan Cooke	CDM Smith	cookedw@cdmsmith.com
Aaron Frantz	CDM Smith	FrantzAR@cdmsmith.com
Ed Garland	HDR/EPA Consultant	edward.garland@hdrinc.com
John Kern	Kern Statistical Services	jkern@KernStat.com
Scott Kirchner	CDM Smith	kirchnersf@cdmsmith.com
Keegan Roberts	CDM Smith	robertsk@cdmsmith.com
James Wands	HDR	james.wands@hdrinc.com
NJDEP Team		
Anne Hayton	NJDEP	Anne.hayton@dep.nj.gov
Jay Nickerson	NJDEP	jay.nickerson@dep.nj.gov
Myla Ramirez	NJDEP	Myla.Ramirez@dep.nj.gov
John Wolfe	LimnoTech	jwolfe@limno.com
CPG Team		
Robert Law	de maximis, Inc.	rlaw@demaximis.com

QAPP Worksheet #9: Project Planning Session Summary
(UFP-QAPP Manual Section 2.5.1 and Figures 9-12)
(EPA 2106-G-05 Section 2.2.5)

Name	Affiliation	E-mail Address
Bill Potter	de maximis, Inc.	otto@demaximis.com
Gary Fisher	CPG	gary.fisher@nokia.com
Doug Reid-Green	CPG	douglas.reid-green@basf.com
Kristen Durocher	AECOM	Kristen.Durocher@aecom.com
Sue Harden	AECOM	susan.harden@aecom.com
John Connolly	Anchor QEA	jconnolly@anchorqea.com
Jim Rhea	Anchor QEA	jrhea@anchorqea.com
Mark LaRue	Anchor QEA	mlarue@anchorqea.com
Peter Israelsson	Anchor QEA	pisraelsson@anchorqea.com
Mike Johns	Windward Environmental	MikeJ@windwardenv.com
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Comments/Decisions: The CPG presented its proposal for the CCMP to EPA, NJDEP, and their consultants. EPA and NJDEP were generally in agreement on the CWCM scope, and discussions focused on the scope of the chemical monitoring of water, sediment, and biota. A follow-up meeting was scheduled for and held on April 17, 2019.

Projected Date(s) of Sampling: Summer/Fall 2019 **Project Manager:** David Marabello	**Site Name:** Diamond Alkali OU4 **Site Location:** LPRSA
Date of Planning Session: 4/17/2019	
Scoping Session Purpose: Discuss scope of the water monitoring component of the Current Conditions Monitoring Program	

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QAPP Worksheet #9: Project Planning Session Summary
(UFP-QAPP Manual Section 2.5.1 and Figures 9-12)
(EPA 2106-G-05 Section 2.2.5)

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QAPP Worksheet #9: Project Planning Session Summary
(UFP-QAPP Manual Section 2.5.1 and Figures 9-12)
(EPA 2106-G-05 Section 2.2.5)

Name	Affiliation	E-mail Address
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Comments/Decisions: The CPG presented a more detailed proposal for the CCMP to EPA, NJDEP, and their consultants. EPA and NJDEP were generally in agreement on the CWCM scope. EPA recommended that the number of vertical casts for turbidity, conductivity, and temperature along the cross-channel transects be increased to seven from CPG's original proposal of three to five locations. CPG accepted this recommendation and indicated that the target for submittal of the CWCM QAPP/FSP would be in mid-May 2019.

QAPP Worksheet #10: Conceptual Site Model
(UFP-QAPP Manual Section 2.5.2)
(EPA 2106-G-05 Section 2.2.5)

Refer to the CPG's QAPP for information on the conceptual site model and data quality objectives (DQOs). The CPG will support the CCMP by establishing current conditions in the LPR and gathering data for further calibration of the sediment transport model.

QAPP Worksheet #11: Project Data Quality Objectives
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

The CPG's QAPP will address project DQOs. Split samples will be used to support goals of the oversight program. The problem and framework for oversight are as follows:

1. **State the Problem**

   The CPG is leading the CWCM investigation; EPA and USACE need to determine the accuracy of CPG-generated data and ensure work is executed in compliance with approved documents. Oversight will include field observation and acceptance of split samples to verify site characterization.

   CDM Smith will assist EPA and USACE in oversight of CPG activities by providing field oversight and analysis of split samples from the CPG's contractor to verify compliance with its approved project plants and accuracy of its data. To evaluate CPG's data accuracy, CDM Smith will accept approximately 5 percent (%) split samples for analysis at locations determined by coordination with the CPG and in consultation with the USACE PM and EPA RPM.

   CDM Smith oversight of the CPG's field investigation will include the following activities:

   - Technical review and evaluation of the CPG's project plans and reports
   - Documentation of field activities observations and deviations from approved plans
   - Acceptance of split samples
   - Sample handling, packaging, and shipping to off-site laboratories
   - Review of CPG-selected sampling locations
   - Comparison of data sets to determine any analytical bias

2. **Identify Study Goals**

   The data will be used to verify, through independent oversight and split sampling analysis, that the CPG activities are in accordance with the CPG's QAPP and health and safety plan (HASP) and that the CPG's data are representative of the site conditions and contaminant concentrations.

QAPP Worksheet #11: Project Data Quality Objectives
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

The overall study goal is to provide data to support model calibration and refinement of contaminant fate and transport model. Split data generated will be used to assess data accuracy; oversight will assess compliance to CPG's governing documents and overall project scope. Oversight and split sample data will be used to answer the environmental questions below:

- Is the CPG contractor complying with approved plans and approved deviations?
- Do the CPG data adequately characterize the site, and are the data representative and useful for project decisions?
- Are the CPG and CDM Smith data complete and accurate?
- Are the data sets comparable as defined on Worksheet #37?
- Do the data show any analytical bias?
- Do CPG and CDM Smith data have relative percent differences (RPDs) within specified measurement performance criteria?

3. Identify Information Inputs

Split surface water samples will be accepted during the CWCM and sent for subcontract laboratory analysis of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (PCDDs/PCDFs), polychlorinated biphenyl (PCB) congeners, select OC pesticides (DDx and dieldrin), total and dissolved Hg, polycyclic aromatic hydrocarbons (PAHs), total and dissolved copper and lead, and SSC, POC, and DOC

Other information inputs include field observations during oversight activities and the existing CWCM data described on Worksheet #13.

4. Define the Boundaries of the Study

CDM Smith will accept split samples during the field investigation activities at a frequency of approximately 5%. Sample locations will be determined in consultation with the USACE PM and EPA RPM. Samples selected for split sampling data will cover a range of locations and concentrations and critical items, such as areas of potential contamination. Samples will be accepted from each media type collected by the CPG.

Sampling oversight will be performed according to the CPG's schedule. The work will occur at the upper portion of the LPR and is anticipated to occur during the second half of 2019.

QAPP Worksheet #11: Project Data Quality Objectives
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

5. Determine the Analytical Approach

Oversight will include field observations and split sample acceptance for analysis of PCDDs/PCDFs, PCB congeners, select OC pesticides (DDx and dieldrin), total and dissolved Hg, PAHs, total and dissolved copper and lead, and SSC, POC, and DOC.

Split data results will enable CDM Smith to evaluate the CPG field program analytical data, and qualitatively assess any potential bias in the CPG data set. Sample results will be evaluated against the CPG's project quantitation limits (PQLs) on Worksheet #15 and against the CPG's data using split sample data quality indicators (DQIs) on Worksheets #12 and #28. Field implementation will be measured against procedures in the CPG's field plans. The project decision criteria below will apply.

6. Project Decision Conditions ("If…, then..." statements)

- If the field work is inconsistent with the CPG QAPP and field sampling plans, then field oversight staff will verify tasks with respect to the CPG's QAPP and HASP, note deviations with the CPG's field project leader, and document such discussions in the Periodic Field Summary Reports sent to USACE and EPA. The CDM Smith PM, USACE PM, and EPA RPM will be informed if there are deviations from the work plan and/or CPG QAPP.
- If the CPG team needs to relocate field sample locations or if there are any changes to the planned field program, then CDM Smith will communicate this change to the USACE PM and EPA RPM and document it on the Daily Field Summary Reports.

CDM Smith will present data findings to USACE and EPA, who will determine if any additional actions are required.

7. Select Performance and Acceptance Criteria

- CDM Smith's QC data will be used to determine split samples data quality and whether sample results are acceptable based on the established project DQOs. Sample results will be compared to the measurement performance criteria of the DQIs.
- Laboratory analysis will be performed through the subcontract laboratory.
- Definitive level data are required for full validation of the data.

QAPP Worksheet #11: Project Data Quality Objectives
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

- Project-specific quantitation limits are specified on Worksheet #15. Analytical data generated will be compared against these limits. Data must meet the DQOs that have been specified for the site. Refer to Worksheets #12 and #28.
- Laboratory quantitation limits (QLs) are anticipated to be low enough for comparison of the split samples to the CPG's data set.
- To verify measurement performance criteria for usability (criteria for measures of precision, accuracy, representativeness, comparability, completeness, and sensitivity) are met, all data will be subject to validation and the outputs will be used to perform a data usability assessment.

8. Detailed Plan of Obtaining Data

Field sampling procedures are described in the CPG's QAPP. See CPG figures in Appendix A for potential split sample locations.

CPG contractor's representatives will collect and fill the sample containers, including the dissolved samples that need to filtered, and CDM Smith's field personnel will prepare the split samples for shipment. CDM Smith will perform sample management and prepare, package, and ship the split samples to the assigned laboratories. The subcontract laboratory will generate the data. The EPA RSCC will communicate laboratory assignments to CDM Smith.

CDM Smith field personnel will observe the implementation of field and sampling activities and note any deviations from the CPG QAPP. Deviations will be brought to the attention of the CPG's contractor and reported to the CDM Smith PM, who will communicate this information to the USACE PM and EPA RPM. These deviations will be documented in the daily communications and in the CDM Smith oversight report. The oversight report will include a discussion of the impact of the deviation(s) on the data quality. The CPG contractor's activities will be documented in the field logbook.

Data Reporting

- Field observations will be recorded using field oversight forms provided in Appendix C.
- Sampling data results will be sent by the subcontract laboratory via email or an online web portal for evaluation and preparation of a data comparability report.

QAPP Worksheet #11: Project Data Quality Objectives
(UFP-QAPP Manual Section 2.6.1)
(EPA 2106-G-05 Section 2.2.6)

- Following completion of laboratory analyses and receipt of all electronic and hard copy data, results will be presented in CDM Smith-generated reports. Reports will include tabulated results and a discussion of the data quality and its comparability with the CPG's data. This review will be used to evaluate the accuracy of the CPG data.

Data Archiving

- Chain-of-custody (COC) information will be uploaded to the EPA Sample Management Office website for archiving and transmittal of information.
- Data generated by the subcontract laboratory will be e-mailed to CDM Smith and USACE within the specified 21-day turnaround time (TAT).
- Data will be verified and validated in accordance with Worksheets #34, #35, and #36.
- Verified and validated electronic analytical data will be uploaded to the Passaic River/Newark Bay EQuIS Enterprise Database.

  Records and documents will be maintained for the period specified in the contract.

QAPP Worksheet #12: Measurement Performance Criteria Table Listing
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

ORGANICS – Aqueous:

- PAHs by EPA 8270D-SIM/D Modified **(12a)**
- OC Pesticides by EPA 1699 **(12b)**
- PCB Congeners by EPA 1668A **(12c)**
- PCDDs/PCDFs by EPA 1613B **(12d)**

INORGANICS – Aqueous:

- Target Analyte List (TAL) Metals – inductively coupled plasma atomic emission spectroscopy (ICP-AES) by EPA 6010B/C **(12e)** and inductively coupled plasma mass spectrometry (ICP-MS) by EPA 6020 **(12f)**
- Trace Hg by EPA 1631 **(12g)**

WET CHEMISTRY – Aqueous:

- SSC by SM 2540D **(12h)**
- DOC by EPA 9060A Modified **(12i)**
- POC by EPA 9060A Modified **(12j)**

SIM – selected ion monitoring
SM – standard method

QAPP Worksheet #12a: Measurement Performance Criteria Table (UFP-QAPP Manual Section 2.6.2) (EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group PAHs by EPA 8270C/D Modified
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field duplicate and split sample	RPD ≤40% if both samples are >10x QL, or absolute difference (ABS) < QL if either result is ≤5x QL
Analytical Precision	Laboratory duplicate	RPD ≤20% of mean if concentration >10 X SDL
Analytical Accuracy/Bias	Ongoing precision and recovery (OPR) standard	60-140 %R for target analytes 15-130 %R for labeled compounds
Analytical Accuracy/Bias	Matrix spike (MS)/matrix spike duplicate (MSD)	50–150%R, RPD ≤40%
Accuracy (preservation)	Temperature blank check evaluated during DV	0–6 degrees Celsius (°C)
Analytical Accuracy/Bias	Surrogate	15-130 %R for labeled compounds
Analytical Accuracy/Bias	Standard reference material (SRM)/ certified reference material (CRM)	25% of reference values with two exceptions up to 50%, applicable for values that are 3x the concentration of the lowest calibration point of ICAL, Supplier-certified limits
Analytical Accuracy/Bias	Method blank/instrument blank	No target compound > LOQ (meet LOQs on Worksheet #15 and laboratory SOP)
Overall Accuracy/Bias-Contamination	Equipment blank	No target compound > LOQ (meet limits on Worksheet #15 and laboratory SOP)
Comparability	Evaluated in data quality assessment (DQA)	Comparable units and methods
Completeness	Data completeness check DQA	≥90% collection and analysis
Sensitivity	Data assessment	Sample LOQs meet project quantitation limit goals (PQLGs) or project action limits (PALs) on Worksheet #15 at a minimum

Worksheet #23 provides more information on the sampling and analytical standard operating procedures (SOPs).
Note: Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS based on extraction and analysis of 1L sample to 20 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for the sample).

QAPP Worksheet #12b: Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Organochlorine Pesticides by EPA 1699
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field duplicate and split samples	RPD ≤40% if both results are >10X SDL ABS ≤ QL
Analytical Accuracy/Bias	Ongoing precision and recovery (OPR) standard	60-130 %R for target analytes 30-150%R for labeled compounds
Analytical Accuracy/Bias	MS	NA
Analytical Accuracy/Bias	PE Sample	25% of reference values with one exception up to 50%, applicable for values that are 3x the concentration of the lowest calibration point of ICAL
Analytical Accuracy/Bias	Surrogates	30%-150%R or laboratory in-house limits. Specific surrogates selected by laboratory.
Accuracy (preservation)	Temperature Blank checks evaluated during DV	0 to 6 degrees Celsius (^{o}C)
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Data Completeness Check	≥90%
Overall Accuracy/Bias-Contamination	Equipment Blank	No target compound above > LOQ (meet QLs on WS#15 and laboratory SOP)
Analytical Accuracy/Bias-Contamination	Method Blank/Instrument Blank	≤ LOQ (Meet limits on WS#15 and laboratory SOP)
Sensitivity	Data Assessment	Sample LOQ meet PQLGs or PALs on WS#15 at a minimum

Worksheet #23 provides more information on the sampling and analytical SOPs.
Note: Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS based on extraction and analysis of 1L sample to 20 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for the sample).

QAPP Worksheet #12c: Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group PCB Congeners by EPA 1668A
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field duplicate and split samples	RPD ≤ 40% if both concentrations ≥ 10X SDL otherwise ABS<QL
Analytical Precision	Initial Precision and Recovery	RSD ≤ 40% for targets and RSD ≤ 50% for labeled compounds
Analytical Precision	Laboratory Duplicate	±20% of mean if concentration >10X SDL
Analytical Accuracy/Bias	Certified Reference Material/ QC Check Sample	25% of reference values with two exceptions up to 50%, applicable for values that are 3x the concentration of the lowest calibration point of ICAL.
Analytical Accuracy/Bias	Calibration Verification Sample (VER)	Per laboratory or method SOP, 70-130% for native analytes and 50-150%R for labeled compounds
Analytical Accuracy/Bias	Initial precision and recovery (IPR) standard	60-140%R 20-135%R for labeled compounds
Analytical Accuracy/Bias	Ongoing precision and recovery (OPR) standard	50-150%R for target analytes and - 15 -140%R for labeled compounds
Analytical Accuracy/Bias	Labeled compound recovery in samples	15-150%R
Accuracy (preservation)	Temperature Blank checks during DV	0 to 6 °C
Comparability	Assessed during DQA	Comparable units, and methods
Completeness	Assessed during DQA	≥ 90% collection and analysis
Overall accuracy/bias	Equipment blanks	≤ LOQs (meet QLs on WS#15 and laboratory SOP)
Sensitivity	Sample results assessed during DQA	Sample LOQs meet PQLGs or PALs on WS#15 at a minimum
Analytical accuracy/ bias	Method blanks assessed during DV and DQA	≤ LOQs (Meet limits on WS#15 and laboratory SOP)

Worksheet #23 provides more information on the sampling and analytical SOPs.

Note: Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS based on extraction and analysis of 1L sample to 20 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for the sample).

QAPP Worksheet #12d: Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group PCDDs/PCDFs by EPA 1613B
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field duplicate and split samples	RPD ≤ 40% if both sample and duplicate concentrations 10X SDL QL, otherwise ABS ≤ QL
Analytical Precision	Laboratory duplicate	±20% of mean if concentration >10 X SDL
Analytical Accuracy/Bias Precision	LCS LCS/LCSD	Per laboratory – not prepared by all laboratories
Accuracy (preservation)	Temperature Blank checks during DV	0 to 6 °C
Analytical Precision	Initial precision and recovery standard	Per laboratory SOP -
Analytical Accuracy/Bias		Various % recovery per laboratory SOP
Analytical Accuracy/Bias	OPR standard Labeled Compounds	70 -130 %R for target analytes and 25-150 %R for labeled compounds
Comparability	Evaluated during DQA	Comparable units, and methods
Completeness	Evaluated during DQA	≥ 90% collection and analysis
Analytical accuracy/bias	Method blanks assessed during DV and DQA	≤ LOQs (meet limits on WS#15 and laboratory SOP)
Overall accuracy/bias	Equipment blanks – assessed during DV and DQA	≤ LOQs (meet QLs on WS#15 and laboratory SOP)
Sensitivity	Sample results reviewed in DQA	Sample LOQs meet PQLGs or PALs on WS#15 at a minimum

Worksheet #23 provides more information on the sampling and analytical SOPs.

Note: Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS based on extraction and analysis of 1L sample to 20 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for the sample).

QAPP Worksheet #12e: Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous (total and dissolved)
Analytical Group TAL Inorganic Metals by EPA 6010B/C
Concentration Level ICP-AES; Low/Medium (micrograms per liter [µg/L])

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field duplicate and split sample	≤40% RPD when both results ≥5xQL ABS ≤ QL when either result <5xQL
Analytical Precision	Laboratory duplicate or MS/MSD	≤20% RPD
Analytical Accuracy	MS	75–125%R
Analytical Accuracy	Postdigestion spike	75–125%R
Analytical Accuracy	LCS	80–120%R
Accuracy (preservation)	Temperature blank	≤6°C
Comparability	Assessed during DQA	Comparable units and methods
Completeness	Assessed during DQA	≥90% collection and analysis
Analytical accuracy/bias	Preparation blank assessed during DV and DQA	≤ QLs (Meet limits on Worksheet #15 and laboratory SOP)
Overall Accuracy/Bias	Equipment blank	≤ QLs (meet QLs on Worksheet #15)
Sensitivity	Sample result assessed during DQA	Sample QLs meet PQLGs or PALs on Worksheet #15 at a minimum

Worksheet #23 provides more information on the sampling and analytical SOPs.

QAPP Worksheet #12f: Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous (total and dissolved)
Analytical Group TAL Inorganic Metals by EPA 6020
Concentration Level ICP-MS; Trace/Low (µg/L)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field duplicate and split sample	≤40% RPD when both results ≥5xQL ABS ≤ QL when either result <5xQL
Accuracy (preservation)	Temperature blank	≤6°C
Overall Accuracy/Contamination	Field equipment blank	≤ QL
Analytical Accuracy	Preparation blank	No constituent > QL
Analytical Accuracy	MS	75–125%R
Analytical Precision	Laboratory duplicate or MS	±20% RPD
Analytical Accuracy	Postdigestion spike	75–125%R
Analytical Precision	Serial dilution test (1:5)	Dilution result ±10% of original result
Sensitivity	Interference check sample	±2xQL of true value or ±20% of true value, whichever is greater
Analytical Accuracy	LCS	80–120%R
Comparability	Assessed during DQA	Comparable units and methods
Completeness	Assessed during DQA	≥90% collection and analysis
Sensitivity/Accuracy	Equipment blank/method blank assessed during DV and DQA	≤ QLs (Worksheet #15 and laboratory SOP)

Worksheet #23 provides more information on the sampling and analytical SOPs.

QAPP Worksheet #12g: Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous (total and dissolved)
Analytical Group Hg (trace) by EPA 1631
Concentration Level Trace (nanograms [ng] per liter)

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field duplicate and split sample	RPD ≤40% if both concentrations ≥5xCRQL, otherwise ABS ≤ QL
Analytical Precision	MS/MSD	RPD ≤25% for values ≥10 QL
Analytical Accuracy/Bias	MS/MSD	70–130%R
Analytical Precision Analytical Accuracy	IPR	RSDs <20% 80–120%R
Analytical Accuracy	OPR, SRM	Laboratory SOP Supplier certified limits
Accuracy (preservation)	Temperature blank check, DV	0–6°C
Comparability	Evaluated during DQA	Comparable units and methods
Completeness	Assessed during DQA	≤90% collection and analysis
Sensitivity/Accuracy	Equipment blank/method blank assessed during DV and DQA	≤ QLs (Worksheet #15 and laboratory SOP)

Worksheet #23 provides more information on the sampling and analytical SOPs.

QAPP Worksheet #12h: Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry – SSC by SM 2540D
Concentration Level Low

DQIs	QC Sample and/or Activity Used to Assess Measurement Performance	Measurement Performance Criteria
Overall Precision	Split sample	≤40% RPD if both sample and split results ≥5QL absolute difference (ABS) ≤ QL when either result <5xQL
	Field duplicate sample	≤40% RPD if both sample and duplicate results ≥5QL absolute difference (ABS) ≤ QL when either result <5xQL
Analytical Accuracy/Bias	QC sample or laboratory-fortified blank	80–120 %R or as stipulated by manufacturer or laboratory
Accuracy (preservation)	Temperature blank check, DV	0–6°C
Analytical Precision	Laboratory matrix duplicate/DV	≤5% RPD if values >5xQL, otherwise ABS ≤ QL
Comparability	DQA	Comparable units QLs and methods
Completeness	DQA	≥90%
Overall Sensitivity/ Accuracy	Method blank	≤ QLs
Sensitivity	Data review	DLs meet project goals

Worksheet #23 provides more information on the sampling and analytical SOPs.

QAPP Worksheet #12i: Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry – DOC by EPA 9060A Modified
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field duplicate and split sample	≤40% RPD if both sample and duplicate results ≥5QL ABS ≤ QL when either result <5xQL
Analytical Accuracy	MS	80–120%R
Analytical Accuracy/Bias	QC sample; laboratory-fortified blank/DV	80–120%R or as updated by laboratory or stipulated by manufacturer
Analytical Precision	Laboratory replicate	RPD ≤20% if values >5x QL, otherwise ABS < QL
Accuracy (preservation)	Temperature blank/DV	0–6°C
Comparability	DQA	Comparable units QLs and methods
Completeness	DQA	≥90%
Analytical Bias/accuracy	Method blanks/calibration blank	≤ QLs
Sensitivity	DQA	DLs meet project goals

Worksheet #23 provides more information on the sampling and analytical SOPs.

QAPP Worksheet #12j: Measurement Performance Criteria Table
(UFP-QAPP Manual Section 2.6.2)
(EPA 2106-G-05 Section 2.2.6)

Matrix Aqueous
Analytical Group Wet Chemistry – POC by EPA 9060A Modified
Concentration Level Low

DQIs	QC Sample or Measurement Performance Activity	Measurement Performance Criteria
Overall Precision	Field duplicate and split sample	≤40% RPD if both sample and duplicate results ≥5QL ABS ≤ QL when either result <5xQL
Analytical Accuracy/Bias	QCS or laboratory-fortified blank or SRM	80–120%R or as stipulated by manufacturer or laboratory
Analytical Precision	Laboratory duplicate/DV	≤30 % RPD if values >5xQL, otherwise ABS ≤ QL
Analytical Accuracy	ICV/continuing calibration verification (CCV)	75–125%R
Accuracy (preservation)	Temperature blank check; DV	0–6°C
Comparability	DQA	Comparable units QLs and methods
Completeness	DQA	≥90%
Analytical Sensitivity/ Accuracy	Method blanks/calibration blank – evaluated in DQA	≤ QLs
		DLs meet project goals

Worksheet #23 provides more information on the sampling and analytical SOPs.

QAPP Worksheet #13: Secondary Data Criteria and Limitations Table
(UFP-QAPP Manual Section 2.7)
(EPA 2106-G-05 Chapter 3: QAPP Elements for Evaluating Existing Data)

Data Type	Data Source	Data Use Relative to Current Project	Factors affecting the Reliability of Data and Limitations on Data Use
Water column monitoring/ chemical data collection	AECOM. 2012. Quality Assurance Project Plan/Field Sampling Plan Addendum. Remedial Investigation Water Column Monitoring/Small Volume Chemical Data Collection. Lower Passaic River Restoration Project. Revision 3. July 2012.	Parent sample data generated by the CPG was compared to split samples collected by CDM Smith. The proposed sampling builds upon this data set.	There are no limitations on use of the data.

QAPP Worksheet #14 &16: Project Tasks & Schedule
(UFP-QAPP Manual Section 2.8.2)
(EPA 2106-G-05 Section 2.2.4)

Activity	Responsible party	Description	Deliverable(s)	Deliverable due date
Draft QAPP	CDM Smith	Prepare and submit draft version of the oversight QAPP to EPA and USACE	Draft QAPP	August 2019
Final QAPP	CDM Smith	Prepare and submit final version of the oversight QAPP to EPA and USACE	Final QAPP	August 2019
QAPP Addenda	CDM Smith	Prepare and submit QAPP addendums for other tasks as appropriate	QAPP addenda	TBD
Laboratory Assignment	CDM Smith	Submit Analytical Services Request Forms	Subcontract laboratories	Due to EPA RSCC 3 weeks before sampling starts
Field Oversight	CDM Smith	Oversight of CWCM field activities	Summary report of field observations, including photos	TBD

Split Samples	CDM Smith	Collection of split samples and submission for analysis	Samples obtained per oversight QAPP shipped to assigned laboratories	Split samples will be collected during the CPG-implemented field sampling program starting August 2019
Laboratory Analysis	Subcontract laboratory	Analysis of the collected split samples	Data package	21 days after last sample is received; specialized analyses may take additional time
DV	CDM Smith	Validation and verification of sample data	Validated data report	21 days after receipt of laboratory data package
Oversight/Data Evaluation	CDM Smith	Evaluation of the CPG-collected data and comparison against CDM Smith-collected split samples	Oversight summary report/data quality summary report	TBD – post-DV completion

QAPP Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

ORGANICS – Aqueous:

- PAHs by EPA 8270D-SIM/D Modified **(15a)**
- OC Pesticides by EPA 1699 **(15b)**
- PCB Congeners by EPA 1668A **(15c)**
- PCDDs/PCDFs by EPA 1613B **(15d)**

INORGANICS – Aqueous:

- TAL Metals – ICP-AES by EPA 6010B/C **(15e)** and ICP-MS by EPA 6020 **(15f)**
- Trace Hg by EPA 1631 **(15g)**

WET CHEMISTRY – Aqueous:

- SSC by SM 2540D **(15h)**
- DOC by EPA 9060A Modified **(15h)**
- POC by EPA 9060A Modified **(15h)**

QAPP Worksheet #15a: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Matrix: Surface water
Analytical Method: Chemical water column analyses (EPA 8270D-SIM Modified [PAHs])
Concentration level (if applicable): Low ng/L

Analyte	PAL[1]	PAL Reference	PQLG[2]	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[3]					
Acenaphthene	None	NA	TBD	1.0	5.0
Acenaphthylene	None	NA	TBD	1.0	4.9
Anthracene	None	NA	TBD	1.0	5.0
Fluorene	None	NA	TBD	1.0	4.9
Naphthalene	None	NA	TBD	1.0	11.6
Phenanthrene	None	NA	TBD	1.0	5.0
Benzo[a]anthracene	None	NA	TBD	1.0	5.0
Benzo[a]pyrene	None	NA	TBD	1.0	5.0
Benzo[b]fluoranthene	None	NA	TBD	1.0	5.0
Benzo[e]pyrene	None	NA	TBD	1.0	5.0
Benzo[g,h,i]perylene	None	NA	TBD	2.0	4.9

QAPP Worksheet #15a: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (UFP-QAPP Manual Section 2.6.2.3 and Figure 15) (EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
Benzo[k]fluoranthene	None	NA	TBD	1.0	5.0
Chrysene	None	NA	TBD	1.0	5.0
Dibenzo[a,h]anthracene	None	NA	TBD	2.0	4.9
Fluoranthene	None	NA	TBD	1.0	4.9
Indeno(1,2,3-cd)pyrene	None	NA	TBD	2.0	10.0
Pyrene	None	NA	TBD	1.0	5.0

Notes:

Laboratory results will be reported in dry weight.

[1] Project-specific action levels have not been approved by EPA for these parameters. Differences in laboratory DLs will be considered when comparing the data.

[2] Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS Analytical Services based on extraction and analysis of 1L sample to 100 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for sample analysis). LOQ is based on 40 CFR Part 136, Appendix B, Revision 2. The lab will report detected results between the SDL and LOQ, qualified as estimated "J" data. Non-detected results will be reported at the SDL.

QAPP Worksheet #15b: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (UFP-QAPP Manual Section 2.6.2.3 and Figure 15) (EPA 2106-G-05 Section 2.2.6)

Matrix: Surface water
Analytical Method: Chemical water column analyses (EPA 1699 [OC pesticides])
Concentration level (if applicable): Low ng/L

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
Dieldrin	None	NA	TBD	0.5	1.6
4,4'-DDE	None	NA	TBD	0.2	2.0
2,4'-DDE	None	NA	TBD	0.2	1.6
4,4'-DDD	None	NA	TBD	0.2	1.9
2,4'-DDD	None	NA	TBD	0.2	1.6
4,4'-DDT	None	NA	TBD	0.2	1.6
2,4'-DDT	None	NA	TBD	0.2	1.6

Notes:
Laboratory results will be reported in dry weight.

[1] Project-specific action levels have not been approved by EPA for these parameters. Differences in laboratory DLs will be considered when comparing the data.

[2] Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS Analytical Services based on extraction and analysis of 1L sample to 200 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for sample analysis). LOQ is based on 40 CFR Part 136, Appendix B, Revision 2. The lab will report detected results between the SDL and LOQ, qualified as estimated "J" data. Non-detected results will be reported at the SDL.

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (UFP-QAPP Manual Section 2.6.2.3 and Figure 15) (EPA 2106-G-05 Section 2.2.6)

Matrix: Surface water
Analytical Method: Chemical water column analyses (EPA 1668A [PCB Congeners])
Concentration level (if applicable): Low pg/L

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 1	None	NA	TBD	1.0	30
PCB 2	None	NA	TBD	1.0	30
PCB 3	None	NA	TBD	1.0	30
PCB 4	None	NA	TBD	2.0	30
PCB 5	None	NA	TBD	2.0	30
PCB 6	None	NA	TBD	2.0	30
PCB 7	None	NA	TBD	2.0	63
PCB 8	None	NA	TBD	2.0	30
PCB 9	None	NA	TBD	2.0	30
PCB 10	None	NA	TBD	2.0	30
PCB 11	None	NA	TBD	2.0	68

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 12(coelutes with PCB 13)	None	NA	TBD	2.0	60
PCB 13(Coelutes with PCB 12)	None	NA	TBD	C12	C12
PCB 14	None	NA	TBD	2.0	30
PCB 15	None	NA	TBD	2.0	30
PCB 16	None	NA	TBD	1.0	30
PCB 17	None	NA	TBD	1.0	30
PCB 18 (Coelutes with PCB 30)	None	NA	TBD	C30	C30
PCB 19	None	NA	TBD	1.0	30
PCB 20 (Coelutes with PCB 28)	None	NA	TBD	C28	C28
PCB 21 (Coelutes with PCB 33)	None	NA	TBD	1.0	60
PCB 22	None	NA	TBD	1.0	30
PCB 23	None	NA	TBD	1.0	30
PCB 24	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 25	None	NA	TBD	1.0	30
PCB 26(Coelutes with PCB 29)	None	NA	TBD	1.0	60
PCB 27	None	NA	TBD	1.0	30
PCB 28(Coelutes with PCB 20)	None	NA	TBD	1.0	60
PCB 29 (Coelutes with PCB 26)	None	NA	TBD	C26	C26
PCB 30 (Coelutes with PCB 18)	None	NA	TBD	1.0	60
PCB 31	None	NA	TBD	1.0	65
PCB 32	None	NA	TBD	1.0	30
PCB 33 (Coelutes with PCB 21)	None	NA	TBD	C21	C21
PCB 34	None	NA	TBD	1.0	30
PCB 35	None	NA	TBD	1.0	30
PCB 36	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 37	None	NA	TBD	1.0	30
PCB 38	None	NA	TBD	1.0	30
PCB 39	None	NA	TBD	1.0	30
PCB 40 (Coelutes with PCB 41 and 71)	None	NA	TBD	1.0	90
PCB 41 (Coelutes with PCB 40 and 71)	None	NA	TBD	C40	C40
PCB 42	None	NA	TBD	1.0	30
PCB 43	None	NA	TBD	1.0	30
PCB 44 (Coelutes with PCB 47 and 65)	None	NA	TBD	1.0	90
PCB 45 (Coelutes with PCB 51)	None	NA	TBD	1.0	60
PCB 46	None	NA	TBD	1.0	30
PCB 47 (Coelutes with PCB 44 and 65)	None	NA	TBD	C44	C44
PCB 48	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 49 (Coelutes with PCB 69)	None	NA	TBD	C69	C69
PCB 50 (Coelutes with PCB 53)	None	NA	TBD	1.0	60
PCB 51(Coelutes with PCB 45)	None	NA	TBD	C45	C45
PCB 52	None	NA	TBD	1.0	30
PCB 53 (Coelutes with PCB 50)	None	NA	TBD	C50	C50
PCB 54	None	NA	TBD	1.0	30
PCB 55	None	NA	TBD	1.0	30
PCB 56	None	NA	TBD	1.0	30
PCB 57	None	NA	TBD	1.0	30
PCB 58	None	NA	TBD	1.0	30
PCB 59 (Coelutes with PCB 62 and 75)	None	NA	TBD	1.0	90
PCB 60	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 61 (Coelutes with PCB 70, 74 and 76)	None	NA	TBD	1.0	120
PCB 62 (Coelutes with PCB 59 and 75)	None	NA	TBD	C59	C59
PCB 63	None	NA	TBD	1.0	30
PCB 64	None	NA	TBD	1.0	30
PCB 65 (Coelutes with PCB 44 and 47)	None	NA	TBD	C44	C44
PCB 66	None	NA	TBD	1.0	30
PCB 67	None	NA	TBD	1.0	30
PCB 68	None	NA	TBD	1.0	30
PCB 69 (Coelutes with PCB 49)	None	NA	TBD	1.0	60
PCB 70 (Coelutes with PCB 61, 74 and 76)	None	NA	TBD	C61	C61
PCB 71 (Coelutes with PCB 40 and 41)	None	NA	TBD	C40	C40
PCB 72	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 73	None	NA	TBD	1.0	30
PCB 74 (Coelutes with PCB 61, 70 and 76)	None	NA	TBD	C61	C61
PCB 75 (Coelutes with PCB 59 and 62)	None	NA	TBD	C59	C59
PCB 76 (Coelutes with PCB 61, 70 and 74)	None	NA	TBD	C61	C61
PCB 77	None	NA	TBD	1.0	30
PCB 78	None	NA	TBD	1.0	30
PCB 79	None	NA	TBD	1.0	30
PCB 80	None	NA	TBD	1.0	30
PCB 81	None	NA	TBD	1.0	30
PCB 82	None	NA	TBD	1.0	30
PCB 83 (Coelutes with PCB 99)	None	NA	TBD	1.0	60
PCB 84	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 85 (Coelutes with PCB 116 and 117)	None	NA	TBD	C117	C117
PCB 86 (Coelutes with PCB 87, 97, 108, 119, 125)	None	NA	TBD	C108	C108
PCB 87 (Coelutes with PCB 86, 97, 108, 119, 125)	None	NA	TBD	C108	C108
PCB 88 (Coelutes with PCB 91)	None	NA	TBD	1.0	60
PCB 89	None	NA	TBD	1.0	30
PCB 90 (Coelutes with PCB 101 and 113)	None	NA	TBD	C113	C113
PCB 91 (Coelutes with PCB 88)	None	NA	TBD	C88	C88
PCB 92	None	NA	TBD	1.0	30
PCB 93 (Coelutes with 95, 98, 100, 102)	None	NA	TBD	C95	C95
PCB 94	None	NA	TBD	1.0	30
PCB 95 (Coelutes with 93, 98, 100, 102)	None	NA	TBD	1.0	150
PCB 96	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 97 (Coelutes with PCB 86, 87, 108 ,119, 125)	None	NA	TBD	C108	C108
PCB 98 (Coelutes with 93, 95, 100, 102)	None	NA	TBD	C95	C95
PCB 99 (Coelutes with PCB 83)	None	NA	TBD	C83	C83
PCB 100 (Coelutes with 93, 95, 98, 102)	None	NA	TBD	C95	C95
PCB 101 (Coelutes with PCB 90 and 113)	None	NA	TBD	C113	C113
PCB 102 (Coelutes with 93, 95, 98, 100,)	None	NA	TBD	C95	C95
PCB 103	None	NA	TBD	1.0	30
PCB 104	None	NA	TBD	1,0	30
PCB 105	None	NA	TBD	1.0	30
PCB 106	None	NA	TBD	1.0	30
PCB 107 (Coelutes with PCB 124)	None	NA	TBD	1.0	60
PCB 108 (Coelutes with PCB 86, 87, 97, 119, 125)	None	NA	TBD	1.0	180

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 109	None	NA	TBD	1.0	30
PCB 110 (Coelutes with PCB 115)	None	NA	TBD	1.0	60
PCB 111	None	NA	TBD	1.0	30
PCB 112	None	NA	TBD	1.0	30
PCB 113 (Coelutes with PCB 90 and 101)	None	NA	TBD	1.0	90
PCB 114	None	NA	TBD	1.0	30
PCB 115 (Coelutes with PCB 110)	None	NA	TBD	C110	C110
PCB 116 (Coelutes with PCB 85 and 117)	None	NA	TBD	C117	C117
PCB 117 (Coelutes with PCB 85 and 116)	None	NA	TBD	1.0	90
PCB 118	None	NA	TBD	1.0	84
PCB 119 (Coelutes with PCB 86, 87, 97, 108, 125)	None	NA	TBD	C108	C108
PCB 120	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 121	None	NA	TBD	1.0	30
PCB 122	None	NA	TBD	1.0	30
PCB 123	None	NA	TBD	1.0	30
PCB 124 (Coelutes with PCB 107)	None	NA	TBD	C107	C107
PCB 125 (Coelutes with PCB 86, 87, 97, 108, 119)	None	NA	TBD	C108	C108
PCB 126	None	NA	TBD	1.0	30
PCB 127	None	NA	TBD	1.0	30
PCB 128 (Coelutes with PCB 166)	None	NA	TBD	1.0	60
PCB 129 (Coelutes with PCB 138, 160 and 163)	None	NA	TBD	C138	C138
PCB 130	None	NA	TBD	1.0	30
PCB 131	None	NA	TBD	1.0	30
PCB 132	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG[2]	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 133	None	NA	TBD	1.0	30
PCB 134 (Coelutes with PCB 143)	None	NA	TBD	1.0	60
PCB 135 (Coelutes with PCB 151 and 154)	None	NA	TBD	C151	C151
PCB 136	None	NA	TBD	1.0	30
PCB 137	None	NA	TBD	1.0	30
PCB 138 (Coelutes with PCB 129, 160 and 163)	None	NA	TBD	1.0	120
PCB 139 (Coelutes with PCB 140)	None	NA	TBD	1.0	60
PCB 140 (Coelutes with PCB 139)	None	NA	TBD	C139	C139
PCB 141	None	NA	TBD	1.0	30
PCB 142	None	NA	TBD	1.0	30
PCB 143 (Coelutes with PCB 134)	None	NA	TBD	C134	C134
PCB 144	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 145	None	NA	TBD	1.0	30
PCB 146	None	NA	TBD	1.0	30
PCB 147 (Coelutes with PCB 149)	None	NA	TBD	1.0	60
PCB 148	None	NA	TBD	1.0	30
PCB 149 Coelutes with PCB 147)	None	NA	TBD	C147	C147
PCB 150	None	NA	TBD	1.0	30
PCB 151 (Coelutes with PCB 135 and 154)	None	NA	TBD	1.0	90
PCB 152	None	NA	TBD	1.0	30
PCB 153 (Coelutes with PCB 168)	None	NA	TBD	1.0	60
PCB 154 (Coelutes with PCB 135 and 151	None	NA	TBD	C151	C151
PCB 155	None	NA	TBD	1.0	30
PCB 156 (Coelutes with PCB 157)	None	NA	TBD	1.0	60

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 157 (Coelutes with PCB 157)	None	NA	TBD	C156	C156
PCB 158	None	NA	TBD	1.0	30
PCB 159	None	NA	TBD	1.0	30
PCB 160 (Coelutes with PCB 129, 138, and 163)	None	NA	TBD	C138	C138
PCB 161	None	NA	TBD	1.0	30
PCB 162	None	NA	TBD	1.0	30
PCB 163 (Coelutes with PCB 129, 138, and 160)	None	NA	TBD	C138	C138
PCB 164	None	NA	TBD	1.0	30
PCB 165	None	NA	TBD	1.0	30
PCB 166 (Coelutes with PCB 128)	None	NA	TBD	C128	C128
PCB 167	None	NA	TBD	1.0	30
PCB 168 (Coelutes with PCB 153)	None	NA	TBD	C153	C153

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 169	None	NA	TBD	1.0	30
PCB 170	None	NA	TBD	1.0	30
PCB 171 (Coelutes with PCB 173)	None	NA	TBD	1.0	60
PCB 172	None	NA	TBD	1.0	30
PCB 173 Coelutes with PCB 171)	None	NA	TBD	C171	C171
PCB 174	None	NA	TBD	1.0	30
PCB 175	None	NA	TBD	1.0	30
PCB 176	None	NA	TBD	1.0	30
PCB 177	None	NA	TBD	1.0	30
PCB 178	None	NA	TBD	1.0	30
PCB 179	None	NA	TBD	1.0	30
PCB 180 (Coelutes with PCB 193) 180	None	NA	TBD	1.0	60
PCB 181	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 182	None	NA	TBD	1.0	30
PCB 183 (Coelutes with PCB 185)	None	NA	TBD	1.0	60
PCB 184	None	NA	TBD	1.0	30
PCB 185 (Coelutes with PCB 183)	None	NA	TBD	C183	C183
PCB 186	None	NA	TBD	1.0	30
PCB 187	None	NA	TBD	1.0	30
PCB 188	None	NA	TBD	1.0	30
PCB 189	None	NA	TBD	1.0	30
PCB 190	None	NA	TBD	1.0	30
PCB 191	None	NA	TBD	1.0	30
PCB 192	None	NA	TBD	1.0	30
PCB 193 (Coelutes with PCB 180)	None	NA	TBD	C180	C180
PCB 194	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 195	None	NA	TBD	1.0	30
PCB 196	None	NA	TBD	1.0	30
PCB 197 (Coelutes with PCB 200)	None	NA	TBD	1,0	60
PCB 198 (Coelutes with PCB 199)	None	NA	TBD	1.0	60
PCB 199 (Coelutes with PCB 198)	None	NA	TBD	C198	C198
PCB 200 Coelutes with PCB 197)	None	NA	TBD	C197	C197
PCB 201	None	NA	TBD	1.0	30
PCB 202	None	NA	TBD	1.0	30
PCB 203	None	NA	TBD	1.0	30
PCB 204	None	NA	TBD	1.0	30
PCB 205	None	NA	TBD	1.0	30
PCB 206	None	NA	TBD	1.0	30
PCB 207	None	NA	TBD	1.0	30

QAPP Worksheet #15c: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
PCB 208	None	NA	TBD	1.0	30
PCB 209	None	NA	TBD	1.0	30
Monochlorobiphenyl	None	NA	TBD	Note 3	Note 3
Dichlorobiphenyl	None	NA	TBD	Note 3	Note 3
Trichlorobiphenyl	None	NA	TBD	Note 3	Note 3
Tetrachlorobiphenyl	None	NA	TBD	Note 3	Note 3
Pentachlorobiphenyl	None	NA	TBD	Note 3	Note 3
Hexachlorobiphenyl	None	NA	TBD	Note 3	Note 3
Heptachlorobiphenyl	None	NA	TBD	Note 3	Note 3
Octachlorobiphenyl	None	NA	TBD	Note 3	Note 3
Nonachlorobiphenyl	None	NA	TBD	Note 3	Note 3

Notes:

Laboratory results will be reported in dry weight.

[1] Project-specific action levels have not been approved by EPA for these parameters. Differences in laboratory DLs will be considered when comparing the data.

[2] Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS Analytical Services based on extraction and analysis of 1L sample to 20 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for sample

analysis). LOQ is based on 40 CFR Part 136, Appendix B, Revision 2. The lab will report detected results between the SDL and LOQ, qualified as estimated "J" data. Non-detected results will be reported at the SDL.

[3] **Total Congeners concentrations determined by calculation** .

QAPP Worksheet #15d: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Matrix: Surface water
Analytical Method: Chemical water column analyses (EPA 1613B [PCDDs/PCDFs])
Concentration level (if applicable): Low pg/L

Analyte	PAL[1]	PAL Reference	PQLG	Sample Detection Limit (SDL)	Limit of Quantitation (LOQ)
Subcontract Laboratory[2]					
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	None	NA	TBD	0.50	50
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	None	NA	TBD	0.50	50
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	None	NA	TBD	0.50	25
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	None	NA	TBD	0.50	25
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	None	NA	TBD	0.50	25
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	None	NA	TBD	0.50	25
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	None	NA	TBD	0.50	25

QAPP Worksheet #15d: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG[2]	MDL	QL
Subcontract Laboratory[3]					
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	None	NA	TBD	0.50	25
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	None	NA	TBD	0.50	25
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	None	NA	TBD	0.50	25
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	None	NA	TBD	0.50	25
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	None	NA	TBD	0.50	25
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	None	NA	TBD	0.50	25
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	None	NA	TBD	0.50	25
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	None	NA	TBD	0.50	25

QAPP Worksheet #15d: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits
(UFP-QAPP Manual Section 2.6.2.3 and Figure 15)
(EPA 2106-G-05 Section 2.2.6)

Analyte	PAL[1]	PAL Reference	PQLG[2]	MDL	QL
Subcontract Laboratory[3]					
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	None	NA	TBD	0.50	5
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	None	NA	TBD	0.50	8
Total HpCDF	None	NA	TBD	Note 3	Note 3
Total HpCDD	None	NA	TBD	Note 3	Note 3
Total HxCDF	None	NA	TBD	Note 3	Note 3
Total HxCDD	None	NA	TBD	Note 3	Note 3
Total PeCDF	None	NA	TBD	Note 3	Note 3
Total PeCDD	None	NA	TBD	Note 3	Note 3
Total TCDF	None	NA	TBD	Note 3	Note 3
Total TCDD	None	NA	TBD	Note 3	Note 3

Notes:

Laboratory results will be reported in dry weight.

[1] Project-specific action levels have not been approved by EPA for these parameters. Differences in laboratory DLs will be considered when comparing the data.

[2] Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS Analytical Services based on extraction and analysis of 1L sample to 20 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for sample

analysis). LOQ is based on 40 CFR Part 136, Appendix B, Revision 2. The lab will report detected results between the SDL and LOQ, qualified as estimated "J" data. Non-detected results will be reported at the SDL.

[3] **Total Congeners concentrations determined by calculation**.

QAPP Worksheet #15e: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (UFP-QAPP Manual Section 2.6.2.3 and Figure 15) (EPA 2106-G-05 Section 2.2.6)

Matrix: Surface water
Analytical Method: Chemical water column analyses (ICP-AES by EPA 6010B/C [TAL Metals])
Concentration level (if applicable): Low

Analyte	PAL[1]	PAL Reference	PQLG[2]	MDL	QL
Subcontract Laboratory[3]					
Copper	None	NA	25 µg/L	TBD	25 µg/L
Lead	None	NA	10 µg/L	TBD	10 µg/L

Notes:

Laboratory results will be reported in dry weight.

[1] Project-specific action levels have not been approved by EPA for these parameters. Differences in laboratory DLs will be considered when comparing the data.

[2] The target PQLG listed is based on laboratory achievable QL.

[3] The stated limits are based on the CPG's QAPP. The subcontract laboratory must have limits at or below the CPG's limits.

QAPP Worksheet #15f: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (UFP-QAPP Manual Section 2.6.2.3 and Figure 15) (EPA 2106-G-05 Section 2.2.6)

Matrix: Surface water
Analytical Method: Chemical water column analyses (ICP-MS by EPA 6020 [TAL Metals])
Concentration level (if applicable): Low

Analyte	PAL[1]	PAL Reference	PQLG[2]	MDL	QL
Subcontract Laboratory[3]					
Copper	None	NA	2 µg/L	TBD	2 µg/L
Lead	None	NA	1 µg/L	TBD	1 µg/L

Notes:

Laboratory results will be reported in dry weight.

[1] Project-specific action levels have not been approved by EPA for these parameters. Differences in laboratory DLs will be considered when comparing the data.

[2] The target PQLG listed is based on laboratory achievable QL.

[3] The stated limits are based on the CPG's QAPP. The subcontract laboratory must have limits at or below the CPG's limits.

QAPP Worksheet #15g: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (UFP-QAPP Manual Section 2.6.2.3 and Figure 15) (EPA 2106-G-05 Section 2.2.6)

Matrix: Surface water
Analytical Method: Chemical water column analyses (EPA 1631 [Hg])
Concentration level (if applicable): Low

Analyte	PAL[1]	PAL Reference	PQLG[2]	MDL	QL
Subcontract Laboratory[3]					
Hg	None	NA			

Notes:

Laboratory results will be reported in dry weight.

[1] A project-specific action level has not been approved by EPA for this parameter. Differences in laboratory DLs will be considered when comparing the data.

[2] The target PQLG listed is based on laboratory achievable QL.

[3] The stated limits are based on the CPG's QAPP. The subcontract laboratory must have limits at or below the CPG's limits.

QAPP Worksheet #15h: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits (UFP-QAPP Manual Section 2.6.2.3 and Figure 15) (EPA 2106-G-05 Section 2.2.6)

Matrix: Surface water
Analytical Method: Physical water column analyses (SM 2540D [SSC], EPA 9060A Modified [POC], and EPA 9060A Modified [DOC])
Concentration level (if applicable): Low

Analyte	PAL[1]	PAL Reference	PQLG[2]	MDL	QL
Subcontract Laboratory[5]					
SSC (1.5 micrometer [µm] filter)	None	NA	4 milligrams per liter (mg/L)	1.2 mg/L	4 mg/L
POC[4]	None	NA	0.2 milligrams per kilogram (mg/kg)	0.1 mg/kg	0.2 mg/kg
DOC	None	NA	1 mg/L	0.1 mg/L	1 mg/L
LSASD[3]					
SSC (1.5 µm filter)	None	NA	1.0 mg/L	NA	1.0 mg/L (with > 1-liter (L) volume sample)
POC[4]	None	NA	0.01 mg/kg	0.005 mg/kg	0.01 mg/kg
DOC	None	NA	0.5 mg/L	0.25 mg/L	0.5 mg/L

Notes:

Laboratory results will be reported in dry weight.

[1] Project-specific action levels have not been approved by EPA for these parameters. Differences in laboratory DLs will be considered when comparing the data.

[2] The target PQLG listed is based on laboratory achievable QL.

[3] LSASD QLs are anticipated to be low enough to allow comparison of the split sample data to the CPG data. DLs are based on communications with Jim Ferretti of the LSASD laboratory and are derived from a LSASD study conducted on water column samples from the New York Bight study. The MDL for POC and DOC are estimates and are one half of the QL.

[4] To increase data usability between these parameters, one container will be accepted for POC and DOC. After laboratory filtration, the filter will be analyzed for POC and the supernatant will be analyzed for DOC. This method will allow for better correlation between the parameters and unit conversion of POC from mg/L to mg/kg with less uncertainty.

[5] The stated limits are based on the CPG's QAPP. The subcontract laboratory must have limits at or below the CPG's limits.

QAPP Worksheet #17: Sampling Design and Rationale
(UFP-QAPP Manual Section 3.1.1)
(EPA 2106-G-05 Section 2.3.1)

Describe and provide a rationale for choosing the sampling approach:
As part of the project, the CPG is implementing an investigation and field sampling program in support of an CCMP. On behalf of EPA, CDM Smith will provide oversight and will accept and analyze split samples. The oversight program is designed to provide technical review and evaluation of associated CPG-implemented QAPPs. Worksheet #10 states the oversight activities to occur during the field sampling programs, and Worksheet #11 provides details on the collection of split samples. Oversight forms are provided in Appendix C; additional forms, if required, will be included in QAPP addenda.

Oversight will include field observation of maintenance checks of instruments and acceptance of physical data for use in characterizing LPR estuarine dynamics and the movement of suspended sediments. Additional oversight will include a review of CPG-selected sampling locations (as necessary, oversight staff will communicate with EPA and USACE on sampling locations).

CDM Smith will accept split samples at a rate of approximately 5% to ensure the CPG's data are accurate. Locations for the split samples will be selected prior to the start of each oversight activity and determined by the EPA RPM, USACE PM, and CDM Smith PM. Field activities will be conducted according to the technical SOPs below:

Describe the sampling action and rationale in terms of matrix to be sampled and frequency (including seasonal considerations), sampling locations (including QC, critical, and background samples), analytical groups and concentration, and number of samples to be taken:
Sampling and analysis rationale, matrices to be sampled, and analytical group are summarized in Worksheet #18.

Decontamination procedures:
Equipment decontamination procedures will be implemented by the CPG in accordance with its QAPP and HASP. CDM Smith will follow the updated Accident Prevention Plan (CDM Smith 2019), including the Site Safety and Health Plan included as an appendix.

Field procedures for these activities are detailed in:
- Technical SOP 1-2 Sample Custody
- Technical SOP 2-1 Packaging and Shipping Environmental Samples
- Technical SOP 4-1 Field Logbook Content and Control
- Technical SOP 4-2 Photographic Documentation of Field Activities
- Data Management Plan

CDM Smith's referenced Technical SOPs are included in Appendix B.

QAPP Worksheet #18: Sampling Locations and Methods
(UFP-QAPP Manual Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.1 and 2.3.2)

Sample ID	*Matrix*	*Depth (feet below ground surface)*	*Type*	*Analyte/Analyte Group*	*Sampling SOP*	*Comments*
Refer to QAPP prepared by Anchor QEA for CPG	Aqueous	Refer to QAPP prepared by Anchor QEA for CPG	Grab	12 split samples for PAHs, OC Pesticides, PCBs (homologs and congeners), PCDDs/PCDFs, Metals (total and dissolved), Trace Mercury (total and dissolved), SSC, DOC, and POC (total for five sampling events) and 1 duplicate (one per 20 samples)	Refer to QAPP prepared by Anchor QEA for CPG	Refer to QAPP prepared by Anchor QEA, worksheet 18 for sampling locations and monitoring event schedule.

Over the course of the study, the CPG is collecting approximately 204 samples for PAHs, OC pesticides, PCBs (homologs and congeners), PCDDs/PCDFs, metals (total and dissolved), trace Hg (total and dissolved), SSC, DOC, and POC, during transect survey sampling. Approximately 5% split samples for each analysis will be accepted during transect surveys over an approximately 6-month instrumentation deployment period. Samples will be collected from five locations on the LPR (cross-channel transects at RM 13.5, 12, 10.2, and 8.4 and an along-channel transect approximately 1 mile upstream to 2 miles downstream of the salt front). The surveys will be conducted during ebb and flood tides during each field event; events will be coordinated to capture low-, medium-low-, medium-high-, and high-flow events, as indicated by the Dundee Dam U.S. Geological Survey gage.

Per the CPG CWCM QAPP, samples will be collected at each location from a depth of 3 feet below river surface (top) and 2 feet above river bottom (bottom) at three predetermined locations along each cross-channel transect line and approximately 12 locations, 0.25 mile apart, on the along-channel transect. Split samples will be accepted from different transects and varied tidal conditions (during flood or ebb tides) during the four field events (low, medium-low, medium-high, and high flow). In general, split samples will be collected from top and bottom samples at a particular sample location along a transect. Samples will be named according to the QAPP prepared by Anchor QEA for CPG; split samples will be designated by the addition of -CDM at end of each sample ID.

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Laboratory: Subcontract laboratory – Katahdin Analytical Services and SGS AXYS Laboratory
List any required accreditations/certifications: provided upon procurement of laboratory
Sample Delivery Method: FedEx Overnight

Analyte/Analyte Group	Matrix	Analytical and Preparation Method/SOP[1,2]	Accreditation Expiration Date	Container(s)[5] (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time[4]	Data Package Turnaround Time
SGS AXYS Laboratory								
PAHs	Aqueous	EPA 8270D-SIM	Provided upon procurement of laboratory	2 x 1L amber glass MS/MSD: Total of four 1-liter glass amber bottles	0–6°C; store in dark	Extract within 7 days	analyze within 40 days of extraction	TAT is 28 calendar days for analysis, 21 days for DV
OC Pesticides		EPA 1699		2 x 1 L amber glass with polytetrafluoroethylene (PTFE)-lined cap		Extract within 7 days	1 year for preparation and analysis	
PCB Congeners		EPA 1668A		2 x 1 L amber glass with PTFE-lined cap		1 year for preparation and analysis	1 year for preparation and analysis	
PCDDs/PCDFs		EPA 1613B		(1) 1 L amber glass		1 year – Method 1613B 1 year for preparation and analysis	6 months 1 year for preparation and analysis	

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times
(UFP-QAPP Manual Section 3.1.2.2)
(EPA 2106-G-05 Section 2.3.2)

Analyte/Analyte Group	Matrix	Analytical and Preparation Method/SOP[1,2]	Accreditation Expiration Date	Container(s)[5] (number, size, and type per sample)	Preservation	Preparation Holding Time	Analytical Holding Time[4]	Data Package Turnaround Time
Katahdin Analytical Services								
TAL Metals	Aqueous	EPA 6010B/C and 6020	Provided upon procurement of laboratory	(2) 1L HDPE + (2) 1L HDPE [extra bottle is for MS analysis]	HNO_3 to pH<2; cool 0–6°C	TBD	6 months	TAT is 21 days for analysis, 21 days for DV
Trace Hg		EPA 1631		(2) 500 mL HDPE	Fill with no headspace; cool 0–6°C; preserve with HNO_3		90 days to analysis	
SSC		SM 2540D 1.5 µm filter		(2) 1L HDPE[6]	Cool 0–6°C	48 hours	7 days	
POC[3]		EPA 9060A Modified					60 days	
DOC		EPA 9060A Modified					28 days	

[1] Subcontract laboratory SOPs to be provided as received from the laboratory.

[2] Method modifications are included on this worksheet and on Worksheet #23.

[3] POC samples will need to be filtered with pre-weighed glass fiber filter upon receipt at the laboratory. Sample custody will be in accordance with CDM Smith Technical SOP 1-2, preserved samples will be shipped according to Technical SOP 4-1, and procedures documented in accordance with Technical SOP 4-1.

[4] Holding times are from date of collection (48-hour preparation holding time for SSC is to perform filtration).

[5] Bottleware and preservatives for split sample acceptance to be provided by the subcontractor laboratory. Sample volume may be limited; CDM Smith will communicate with the EPA RSCC or the subcontract laboratory to prioritize analysis or to combine bottleware where applicable. Actual bottleware may vary based on discussions with subcontract laboratory to achieve limits specified on Worksheet #15.

[6] To increase data usability between these parameters, one container will be accepted for POC and DOC. After laboratory filtration, the filter will be analyzed for POC and the supernatant will be analyzed for DOC. This method will allow for better correlation between the parameters and unit conversion of POC from mg/L to mg/kg with less uncertainty.

QAPP Worksheet #20: Field Quality Control Summary
(UFP-QAPP Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.5)

Matrix	Analyte/Analyte Group	Method/SOP	Field Samples	Field Duplicate	MS/MSD	Field Equipment Blanks	Trip Blanks	Other	Total
SGS AXYS Laboratory									
Aqueous	PAHs	EPA 8270D-SIM	Minimum 12 split samples from 12 events at 4 transects and 1 fixed station	12 (1 per event; 12 events)	12 MS 12 MSD (1 per event; 12 events)	0	0	0	24
Aqueous	OC Pesticides	EPA 1699	Minimum 12 split samples from 12 events at 4 transects and 1 fixed station	12 (1 per event; 12 events)	12 MS 12 MSD (1 per event; 12 events)	0	0	0	24
Aqueous	PCB Congeners	EPA 1668A	Minimum 12 split samples from 12 events at 4 transects and 1 fixed station	12 (1 per event; 12 events)	NA	0	0	0	24
Aqueous	PCDDs/PCDFs	EPA 1613B	Minimum 12 split samples from 12 events at 4 transects and 1 fixed station	12 (1 per event; 12 events)	NA	0	0	0	24

QAPP Worksheet #20: Field Quality Control Summary
(UFP-QAPP Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.5)

Matrix	Analyte/Analyte Group	Method/SOP	Field Samples	Field Duplicate	MS/MSD	Field Equipment Blanks	Trip Blanks	Other	Total
Katahdin Analytical Services									
Aqueous (total)	Trace Hg	EPA 1631	Minimum 12 split samples from 12 events at 4 transects and 1 fixed station	12 (1 per event; 12 events)	12 MS 12 MSD (1 per event; 12 events)	0	0	0	24
Aqueous (dissolved)	Trace Hg	EPA 1631	Minimum 12 split samples from 12 events at 4 transects and 1 fixed station	12 (1 per event; 12 events)	12 MS 12 MSD (1 per event; 12 events)	0	0	0	24
Aqueous (total)	TAL Metals	EPA 6010B/C or 6020	Minimum 12 split samples from 12 events at 4 transects and 1 fixed station	12 (1 per event; 12 events)	12 MS 12 MSD (1 per event; 12 events)	0	0	0	24
Aqueous (dissolved)	TAL Metals	EPA 6010B/C or 6020	Minimum 12 split samples from 12 events at 4 transects and 1 fixed station	12 (1 per event; 12 events)	12 MS 12 MSD (1 per event; 4 events)	0	0	0	24

QAPP Worksheet #20: Field Quality Control Summary
(UFP-QAPP Section 3.1.1 and 3.1.2)
(EPA 2106-G-05 Section 2.3.5)

Matrix	Analyte/Analyte Group	Method/SOP	Field Samples	Field Duplicate	MS/MSD	Field Equipment Blanks	Trip Blanks	Other	Total
Aqueous	SSC	SM 2540D 1.5 µm filter	Minimum 12 split samples from 12 events at 4 transects and 1 fixed station	12 (1 per event; 12 events)	12 MS 12 MSD (1 per event; 12 events)	0	0	0	24
Aqueous	DOC	EPA 9060A Modified	Minimum 12 split samples from 12 events at 4 transects and 1 fixed station	12 (1 per event; 12 events)	12 MS 12 MSD (1 per event; 12 events)	0	0	0	24
Aqueous	POC	EPA 9060A Modified	Minimum 12 split samples from 12 events at 4 transects and 1 fixed station	12 (1 per event; 12 events)	12 MS 12 MSD (1 per event; 12 events)	0	0	0	24

Notes:
Due to the dynamic nature of this task order, additional tasks will be included in QAPP addenda.
POC and DOC will be accepted in the same container. Laboratory will filter sample and report suspended solids associated with the 0.7 µm filter. Worksheet #23 describes the project-specific method modifications.
Laboratory QC samples (MS and MSD) are not included in the total number of samples; "minimum" reflects that additional sampling events may be implemented and therefore additional split samples may be required to accommodate the 5% split sampling frequency.

QAPP Worksheet #21: Field SOPs
(UFP-QAPP Manual Section 3.1.2)
(EPA 2106-G-05 Section 2.3.2)

SOP # or reference	Title, Revision, Date, and URL (if available)	Originating Organization	SOP option or Equipment Type (if SOP provides different options)	Modified for Project? Y/N	Comments
1-2	Sample Custody, Rev. 8, February 2015	CDM Smith	NA	Y	-Sample tags are not required. -Distribution of chains of custody (COCs) per EPA Region 2 guidelines. -Use waterproof ink for any handwritten labels.
2-1	Packaging and Shipping Environmental Samples, Rev. 6, February 2015	CDM Smith	NA	Y	-If wrapping material is placed around the label, write the sample number and analysis on the outside of the wrap and place in a ziplock bag and close. -Vermiculite shall not be used. Include cooler temperature blank.
4-1	Field Logbook Content and Control, Rev. 8, February 2015	CDM Smith	Digital Camera	Y	Logbook notes should include decontamination procedures and equipment used, descriptions of photographs taken, problems encountered and notes of conversations with pertinent project team members. Details of samples acceptance including equipment used, and visual observations.
4-2	Photographic Documentation of Field Activities, Rev. 9, February 2015	CDM Smith	NA	N	*[Comments include details about the activity or modifications]*

[1] Bottleware and preservatives for split sample acceptance provided by the subcontractor laboratory.

[2] For each sample collected and shipped, the following information will be recorded (at a minimum) in the field logbook:

- Name of field personnel
- CDM Smith assigned sample number/location
- Date sampled and date shipped
- Sample location number
- Corresponding laboratory sample number
- Media type and analysis to be performed
- Sample volume and containers; preservatives added to sample
- Any unusual discoloration or evidence of contamination
- Field parameter measurements and calculations
- Courier airbill number and means of delivery to the laboratory
- General observations

QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection (UFP-QAPP Manual Section 3.1.2.4) (EPA 2106-G-05 Section 2.3.6)

Field Equipment	Activity	SOP Reference	Title or Position of Responsible Person	Frequency	Acceptance Criteria	Corrective Action
NA – equipment calibration, maintenance, testing, and inspection will be performed by the CPG's contractor						

QAPP Worksheet #23: Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
EPA 8270D-Modified SIM	*Analytical Method for the Determination of Polycyclic Aromatic Hydrocarbons (PAH), Alkylated Polycyclic Aromatic Hydrocarbons, and Alkanes.* Revision 12.06. December 2018.	Definitive	PAHs	gas chromatography (GC)/low-resolution mass spectrometry (LRMS)	N
EPA 1699	*Analytical Procedure for Organochlorine Pesticides by Isotope Dilution HRGC/HRMS by EPA Method 1699.* Revision 6.10 May 2018	Definitive	OC Pesticides	HRGC/HRMS	N
EPA 1668A	*Analytical Method for the Determination of 209 PCB Congeners by EPA Method 1668A, EPA Method 1668C, or EPA Method CBC01.2.* Revision 12.02. April2019.	Definitive	PCB Congeners	HRGC/HRMS	N
EPA 1613B	*Analytical Method for the Determination of Polychlorinated Dibenzodioxins and Dibenzofurans by EPA Method 1613B, 8290/8290A, or DLM02.2.* Revision 20.10. July 2017.	Definitive	PCDDs/PCDFs	HRGC/HRMS	N
EPA 6010B/C	*Inductively Coupled Plasma-Atomic Emission Spectrometry.* Revision 2. December 1996.	Definitive	Metals (no Hg)	ICP-AES	N
EPA 6020	*Standard Operating Procedure: Inductively Coupled Plasma – Mass Spectrometry Analysis.* Revision 2. April 1, 2011.	Definitive	Metals (no Hg)	ICP-MS	N
EPA 1631	*Total Hg Using Atomic Fluorescence Spectroscopy*. Revision 2. August 28, 2009.	Definitive	Hg (trace)	cold vapor atomic fluorescence spectrometry (CVAFS)	N

HRGC – high-resolution gas chromatography
HRMS – high-resolution mass spectrometry

QAPP Worksheet #23: Analytical SOPs
(UFP-QAPP Manual Section 3.2.1)
(EPA 2106-G-05 Section 2.3.4)

SOP #	Title, Date, and URL (if available)	Definitive or Screening Data	Matrix/Analytical Group	SOP Option or Equipment Type	‡Modified for Project? Y/N
SM 2540D	Total Suspended Solids (Non-Filterable Residue) by EPA Method 160.2 and Standard Method 2540D. 2017. Or latest revision.	Definitive	Aqueous/SSC	Filter, oven, balance	Y – see below
Project-specific Modification: Use 1.5 µm filter (ProWeigh, Environmental Express, Model F93447MM-X). Use entire sample bottle to filter. Rinse with deionized water to capture all the solids or until filter refusal. Filter within 48 hours of collection. Subcontract laboratory will communicate with CDM Smith if the SSC is relatively high and may clog the filter.					
EPA 9060A Modified	*Analysis of TOC, DOC, and TIC in Aqueous Samples Using the Shimadzu Carbon Analyzer: EPA Method 415.1, SW846 9060, and SM 5310B.* 2017. Or latest revision.	Definitive	Aqueous/DOC	Carbon analyzer/infra-red (IR)/flame ionization detector (FID)	Y – see below
Project-specific Modification: Use a 0.7 µm glass fiber filter (Whatman, 25-millimeter (mm) diameter, Model 1825-025). Filters will be precombusted and tared; after filtration, filters will be dried and reweighed. The mass of suspended solids on the 0.7 µm filter will be reported in the data package. Dried POC filters will be stored frozen until analysis. Prior to combustion, POC filter will be exposed to hydrochloric fumes for 24 hours to remove inorganic carbon. Subcontract laboratory will communicate with CDM Smith if the SSC is relatively high and carbon load may saturate the detector. POC will be reported in units of mg/kg and mg/L (i.e., volume of water filtered).					
EPA 9060A Modified	*Determination of Total Organic Carbon in Solids Using the EPA Region II Method Lloyd Kahn and SW846 8060 MOD*. 2019. Or latest revision.	Definitive	Aqueous/POC	Filter and Carbon Analyzer with IR or FID	Y – see below
Project-specific Modification: Use combustible 0.7 µm glass fiber filter (Whatman, 25 mm diameter, Model 1825-025). Filter within 48 hours of sample collection and preserve. Expose to hydrochloric acid fumes to remove inorganic carbon. Combust entire filter to reduce errors. Reported DOC values will be the average of two analyses.					

TOC – total organic carbon

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference
GC/MS EPA 8270	Initial calibration: 5 points standards	Upon award of the contract, whenever the laboratory takes corrective action that may change or affect the initial calibration criteria, or if the continuing calibration acceptance criteria have not been met	Relative response factor (RRF) ≥ minimum acceptable RRF listed in Table 5 of procedure; All target compounds, initial RSD ≤10% or 20% and correlation coefficient (r) > 0.995; %RSD ≤ value listed in Table 5 of procedure	Inspect system for problems (e.g., clean ion source, change the column, service the purge and trap device), correct problem, recalibrate	EPA CLP Laboratory GC/MS Technician	*Analytical Method for the Determination of Polycyclic Aromatic Hydrocarbons (PAH), Alkylated Polycyclic Aromatic Hydrocarbons, and Alkanes*
	CCV	Once every 12 hours	Percent difference (%D) ≤15% or <30% as required	Inspect system; correct problem; recalibrate the instrument, reanalyze samples and standards		
	Calibration Standards Verification	Each lot of standards	Per laboratory-established control limits	Inspect system; correct problem; rerun standard and affected samples		
	Tuning	Daily: every 12 hours	Response factors and RRF as method specified	Inspect system; correct problem; rerun standard and affected samples		

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference[1]
FID EPA 9060	Initial and continuing calibration as required in SOP	ICAL after instrument set up, after major instrument changes and when continuing calibration criteria are not met; calibration verification every 10 samples or per laboratory SOP	r >0.995; ICAL and CCV %D±10%	Inspect system, correct problem, rerun calibration and affected samples	Laboratory analyst/QA officer – TBD	*Determination of Total Organic Carbon in Solids Using the EPA Region II Method Lloyd Kahn and SW846 8060 MOD*
HRGC/HRMS EPA 1613, 1668 and 1699	Initial calibration and calibration verification check per laboratory SOP	After setup, after instrument changes or failures of checks and every 12 hours	%RSD and %R per laboratory SOPs	Check, correct; recalibrate and rerun all samples analyzed after last valid calibration check	Laboratory analyst/QA officer – TBD	*Analytical Method for the Determination of Polychlorinated Dibenzodioxins and Dibenzofurans by EPA Method 1613B, 8290/8290A, or DLM02.2* *Analytical Method for the Determination of 209 PCB Congeners by EPA Method 1668A, EPA Method 1668C, or EPA Method CBC01.2* *Analytical Procedures for Organochlorine Pesticides by Isotope Dilution HRGC/HRMS by EPA Method 1699*
	Calibration checks: CCVs per laboratory SOP	Daily: every 12 hours	%R per laboratory SOP	Check, correct; recalibrate and rerun all samples analyzed after last valid calibration check		

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference[1]
HRGC/HRMS high resolution mass spectrometry	Initial calibration and calibration verification check	After setup, prior to run, and after instrument changes or failures of checks	% RSD and %R per laboratory SOPs	Check, correct; recalibrate and rerun all samples analyzed after last valid calibration check	Laboratory GC/MS technician	*Analytical Method for the Determination of Polychlorinated Dibenzodioxins and Dibenzofurans by EPA Method 1613B, 8290/8290A, or DLM02.2* *Analytical Method for the Determination of 209 PCB Congeners by EPA Method 1668A, EPA Method 1668C, or EPA Method CBC01.2* *Analytical Procedures for Organochlorine Pesticides by Isotope Dilution HRGC/HRMS by EPA Method 1699*
	Calibration checks: CCVs per laboratory SOP	Daily: beginning of run and after every 10 samples and at end of analytical run	%R per laboratory SOP			
	Initial calibration	After setup, prior to run, and after instrument changes or failures of checks	%RSD and %R per laboratory SOPs			
	Calibration verification	Once every 12 hours	%D must ≥-25% to 25%, %RSD must be ≤20.0%	Inspect system, recalibrate the instrument, and reanalyze samples		
CVAFS	Per method and laboratory SOP	Calibration	Per method/laboratory SOP ICAL ≤15% RSD	Inspect the system, correct problem, recalibrate, and reanalyze samples	Assigned laboratory personnel	*Total Hg Using Atomic Fluorescence Spectroscopy*
		ICV: check daily when instrument is in use	85–115%R for Total Hg; 80–120%R for methyl Hg	Inspect the system, correct problem, recalibrate, and reanalyze samples	Assigned laboratory personnel	
		CCV: beginning and after every 10 samples	77–123%R for total Hg; 67–133%R for methyl Hg			

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference[1]
ICP-AES EPA 6010	See method/per instrument manufacturer's procedures	Initial calibration: daily or once every 24 hours and each time the instrument is set up	ICP-AES: Per instrument manufacturer's procedures, at least two standards	Inspect the system, correct problem, recalibrate, and reanalyze samples	Laboratory ICP-AES technician	TBD
	Initial calibration	Daily: after tuning and optimizing instrument	r >0.995 with a minimum of three standards and a blank; for MS, a minimum of three replicate integrations are required for data acquisition	Repeat analysis; reprepare calibration standards and reanalyze		
	ICV	Before sample analysis	90–110%R; source of standard separate from calibration standards	Recalibrate; prepare fresh ICV standards; correct problem reanalyze samples		
	Reporting limit standard	After initial calibration verification standard	80–120%R or concentration ≤30%D (from true value)	Reanalyze failed standard		
	CCV	Every 10 samples and beginning and at end of analytical sequence	90–110%R; source of standard separate from calibration standards	Recheck; recalibrate and rerun all samples analyzed after last valid CCV		

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference[1]
ICP-MS EPA 6020	Per instrument manufacturer's recommended procedures	Initial calibration: daily and each time the instrument is set up; verify performance daily or once QC checks are noncompliant	r ≥0.998; minimum of 3 standards and a blank	Inspect the system, correct problem, recalibrate, and reanalyze samples.	Laboratory or subcontractor Laboratory ICP-MS technician/ analyst/QA officer	TBD
	Instrument performance check	Daily: after tuning and optimizing instrument	RSD <5% after at least 4 runs of the tuning solution	Repeat analysis; reprepare calibration standards and reanalyze		
	Initial calibration check – ICV	Before sample analysis	90–110% recovery; source of standard separate from calibration standards	Recalibrate instrument; prepare fresh ICV standards; do not analyze samples until problem is fixed		
	Low-level ICV standard	After initial calibration verification standard	70–130% recovery (concentration ±30% of true value); prepared from calibration standards			
	CCV	Every 10 samples and at end of analytical sequence	90–110% recovery; mid-range of ICV standard	Find problem; recalibrate and rerun all samples analyzed after last valid CCV		
	CCV: ISM0.1	Beginning and end of run; 10% frequency or every 2 hours during each run	Per instrument manufacturer's recommended procedures, with at least 2 standards. A minimum of three replicate integrations are required for data acquisition			
	Low-level CCV standard	Beginning and end of run; 10% frequency or every 2 hours during an analysis run	70–130% recovery; prepared from calibration standards			

QAPP Worksheet #24: Analytical Instrument Calibration
(UFP-QAPP Manual Section 3.2.2)
(EPA 2106-G-05 Section 2.3.6)

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Title/Position Responsible for Corrective Action	SOP Reference[1]
Soil TOC Analyzer	Calibration and corrective action per manufacturer's instruction; no samples shall be analyzed if instrument calibration exceeds the acceptance criteria				Laboratory analyst/QA officer – TBD	TBD
Thermometer	Calibration	Quarterly; serviced annually	±1°C of true value of National Institute of Standards and Technology-traceable thermometer	Replace defective thermometer		
Analytical Balance	Calibration verification	Daily: before use	See instrument manual	Troubleshoot per equipment manual/call for repair	Laboratory analyst/QA officer – TBD	
	Mass check	Daily: before use	See instrument manual			
	Temperature check	Annually	±2°C			
Oven	Serviced annually per manufacturer's instruction					
pH Meter	Daily buffer checks (2-point bracketing sample pH)	Before use/per batch; other checks per rental company/manufacturer's recommendations	±0.1 pH units or ±0.05 pH units	Recheck; replace buffer solutions and recheck. If still fails perform instrument check or place out of service	Laboratory analyst/QA officer – TBD	

Notes:
1. The Field and Analytical Services Teaming Advisory Committee (FASTAC) decision process will be used for procuring laboratory services. CDM Smith subcontract laboratory's calibration and/or method SOPs will be utilized to meet calibration criteria. Specific instrument information (manufacturer and model) is not available at this time.
2. TBD – reference SOP depends on the laboratory assignment. EPA maintains the CLP laboratory SOP information. For analyses performed by a subcontract laboratory, CDM Smith will obtain relevant SOPs.
3. The laboratory SOP will include the calibration range information.

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection
(UFP-QAPP Manual Section 3.2.3)
(EPA 2106-G-05 Section 2.3.6)

Subcontract laboratories (Katahdin Analytical Services and SGS AXYS Laboratory) will be used for analysis of split samples. Maintenance, testing, and inspection frequencies are documented in the laboratory's SOPs.

QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal (UFP-QAPP Manual Section 3.3) (EPA 2106-G-05 Section 2.3.3)

Sampling Organization: CDM Smith
Laboratory: Subcontract Laboratory (SGS AXYS Laboratory and Katahdin Analytical Services)
Method of sample delivery (shipper/carrier): FedEx Overnight
Number of days from reporting until sample disposal: Subcontract Laboratory – TBD

Activity	Organization and title or position of person responsible for the activity	SOP reference
Sample labeling	CDM Smith FTL	CDM Smith Technical SOP 2-1
COC form completion	CDM Smith sample manager	CDM Smith Technical SOP 1-2
Packaging	CDM Smith sample manager	CDM Smith Technical SOP 1-2 and 2-1; EPA CLP guidance for field samplers
Shipping coordination	CDM Smith FTL, ASC/CLP coordinator	CDM Smith Technical SOP 2-1
Sample receipt, inspection, and log-in	Laboratory custodian (subcontract laboratory)	Analytical SOW and laboratory SOP
Sample custody and storage	CDM Smith and laboratories (subcontract laboratory)	CDM Smith Technical SOP 1-2; analytical SOW or laboratory technical SOP
Sample disposal	Laboratory custodian (subcontract laboratory)	Laboratory technical SOP

Notes:

1. Duplicates will be indicated by adding 100 to the location number. For example, MW1-100-011012 would indicate a duplicate sample collected from MW-1 on January 10, 2012.

QAPP Worksheet #28: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

ORGANICS – Aqueous:

- PAHs by 8270D-SIM Modified **(28a)**
- OC Pesticides by EPA 1699 **(28b)**
- PCB Congeners by 1668A **(28c)**
- PCDDs/PCDFs by EPA 1613B **(28d)**

INORGANICS – Aqueous:

- TAL Metals – ICP-AES by EPA 6010B/C **(12e)** and ICP-MS by EPA 6020 **(12f)**
- Trace Hg by EPA Method 1631 **(12g)**

WET CHEMISTRY – Aqueous:

- SSC by SM 2540D **(28h)**
- DOC by EPA 9060A Modified **(28i)**
- POC by EPA 9060A Modified **(28j)**

QAPP Worksheet #28a: Analytical Quality Control and Corrective Action (UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group PAHs
Analytical Method/SOP Reference EPA 8270D-SIM Modified

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	per extract batch	Per laboratory SOP	Investigate and correct per laboratory SOP	Laboratory analyst	No analyte > LOQ
Laboratory Duplicate	1 per 20 samples	Per laboratory SOP	Investigate and correct; reanalyze affected samples; Flag outliers	Laboratory analyst	≤20% RPD if target concentration >10x SDL
MS/MSD	1 per 20 samples or with each group of field samples	Per laboratory SOP	Investigate and correct; document in data summary	Laboratory analyst	50–150%R, RPD ≤ 40%
Surrogate	Every field and QC sample, standards, blanks	Per laboratory SOP	Identify source of problem, make other adjustments, and reanalyze	Laboratory analyst	15-130% for labeled compounds
Split Samples/Field Duplicates	1 per 20 samples	None	Data assessor to inform CDM Smith sample manager if measurement performance criteria (MPC) is exceeded; address in DQA	CDM Smith ASC	≤40% RPD (for results ≥10xSDL) or ABS <2xQL
Temperature Blank	1 per cooler	0–6°C	Note outlier in laboratory narrative; inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory analyst	≤6°C

Note: Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS based on extraction and analysis of 1L sample to 20 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for the sample).

QAPP Worksheet #28b: Analytical Quality Control and Corrective Action (UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group OC Pesticides
Analytical Method/SOP Reference EPA 1699

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples/Field Duplicates	1 per 20 field samples	RPD ≤50% if both results are >5x QL	Evaluate during DV	DV staff	RPD ≤40% if both samples are >5x QL
Method Blank	1 per batch (up to 20 samples)	Target compounds < LOQ;	Identify source and attempt to eliminate; re-extract and/or reanalyze blank and affected samples (if sufficient sample remains); alert project team if repeated or widespread exceedances impact project DQOs; report results if sample results >5x blank result or sample results ND.	Laboratory analyst/section supervisor	No target compounds > LOQ
Equipment Blank	1 per week per sampling team	Target compounds <LOQ;	Evaluate impacts on data on a case-by-case basis	DV staff	No target compounds > LOQ
Surrogates	Every sample	Laboratory-specified	Check calculations and instrument performance; recalculate; reanalyze	Laboratory analyst/section supervisor	30–150%R as laboratory specified
ORP	1 per batch (up to 20 samples)	60-130 %R for target analytes 30-150%R for labeled compounds	Reprepare and/or reanalyze affected samples; qualify data as needed	Laboratory analyst/section supervisor	60-130 %R for target analytes 30-150%R for labeled compounds
PE Sample	1 per method per year	25% of reference values with one exception up to 50%, applicable for values that are 3x the concentration of the lowest calibration point of ICAL	Provide feedback to laboratory/laboratory reviews data	Project chemist/laboratory staff	25% of reference values with one exception up to 50%, applicable for values that are 3x the concentration of the lowest calibration point of ICAL

Note: Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS based on extraction and analysis of 1L sample to 20 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs

achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for the sample).**QAPP**

Worksheet #28c: Analytical Quality Control and Corrective Action
(UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6)
(EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group PCB Congeners
Analytical Method/SOP Reference EPA 1668A

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per 20 samples immediately after OPR	< LOQ or 1/3 PAL unless sample concentrations >10x blank levels	If samples nondetect or if lowest sample result is >10x the blank—no action, otherwise redigest and reanalyze or qualify data	Laboratory analyst	No analyte > LOQ, or 1/3 PAL, whichever is greater
Laboratory Duplicate	1 per 20 samples	±20% mean for concentrations >10x SDL	Flag outliers	Laboratory analyst	RPD ≤20%
Certified Reference Material or QC Sample	Periodically but at least quarterly	25% of reference values with two exceptions up to 50%, applicable for values that are 3x the concentration of the lowest calibration point of ICAL.	Check standards; recalibrate if required	Laboratory analyst	25% of reference values with two exceptions up to 50%, applicable for values that are 3x the concentration of the lowest calibration point of ICAL.
Calibration Verification Sample	Beginning of each 12-hour shift	Per laboratory or method SOP	Adjust and/or recalibrate	Laboratory analyst	70–130% for native analytes and 50–150% for labeled compounds
IPR	Prior to sample analysis	Per laboratory SOP	Investigate and correct	Laboratory analyst	60–140%R for target compounds; 20–135%R for labeled compounds
OPR	1 per batch of 20 samples	Per laboratory SOP	Identify source of problem, recalibrate if needed/make other adjustments and reanalyze		50–150%R for target analytes and 15–140%R for labeled compounds
Labeled Compound Recovery in Samples	Add to each blank, sample, and QC sample preanalysis	15–150%R	Re-extract and reanalyze		25–150%R
Split Samples/Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in DQA	CDM Smith ASC	RPD ≤40%; ABS< QL for samples <10x SDL
Temperature Blank	1 per cooler	0–6°C	Note outlier in laboratory narrative. Inform FTL of failure and need for more ice; check packing procedure	Laboratory analyst	≤6°C

Note: Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS based on extraction and analysis of 1L sample to 20 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for the sample).

QAPP Worksheet #28d: Analytical Quality Control and Corrective Action (UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group PCDD/PCDF
Analytical Method/SOP Reference EPA 1613B

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank	1 per 20 samples	TCDD/F <0.5 pg/sample, PeCDD/F, HxCDD/F, HpCDD/F <1.0 pg/sample, OCDD/F <5 pg/sample unless sample concentrations >10x blank levels (per SOP)	If samples nondetect or if lowest sample result is >10x the blank—no action, otherwise redigest and reanalyze	Laboratory analyst	No analyte > LOQ
Initial Precision and Recovery	Prior to sample analysis	Per laboratory SOP, or method limits	Investigate and correct	Laboratory analyst	Per method/laboratory SOP
QC Check	Quarterly at a minimum	Per method	Per method	Laboratory analyst	Per method/laboratory SOP
OPR	1 per batch of 20 samples	70 -130 %R for target analytes and 25-150 %R for labeled compounds	Identify source of problem, make other adjustments; redigest if needed and reanalyze	Laboratory analyst	70 -130 %R for target analytes and 25-150 %R for labeled compounds
VER	Start of each 12-hour shift	Per laboratory SOP, or method limits	Investigate and correct; repeat analysis	Laboratory analyst	Individual laboratory established limits per SOP or per method Table 6
Labeled Compounds	Start of each 12-hour shift	Per laboratory SOP	Investigate and correct the problem; repeat the test with a smaller amount of soil/sediment	Laboratory analyst	Individual laboratory established limits per SOP. Method range for all PCDDs/PCFS is 17-197%R (Table 7 of method)
Split Samples/Field Duplicates	1 per 20 samples	None	Data assessor to inform SM if MPC is exceeded; address in DQA	CDM Smith ASC	≤40% RPD (for results ≥10x SDL)
Temperature Blank	1 per cooler	0–6°C	Note outlier in laboratory narrative; inform CDM Smith of failure and need for additional coolant; check packing procedure	Laboratory analyst	≤6°C

Note: Typical SDLs (sample detection limits) and Limits of Quantification (LOQ) are limits obtained by SGS AXYS based on extraction and analysis of 1L sample to 20 µL final volume, and are based on 6-point calibration curve. Quantification Limits (QLs) must be supported by the low-level standard in the calibration curve. Actual SDLs and QLs achieved will be sample-specific accounting for all sample preparation and analysis factors (e.g., actual volume of sample analyzed and any dilution used for the sample).

QAPP Worksheet #28e: Analytical Quality Control and Corrective Action (UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous (Total and dissolved)
Analytical Group TAL Inorganic Metals ICP-AES
Analytical Method/SOP Reference EPA 6010B/C

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples/Field Duplicates	1 per 20 samples	None	Notify SM and address in DQA	CDM Smith ASC and SM	≤40% RPD if both results ≥5QL; ABS ≤ CRQL when either result <5xQL
Temperature Blank	1 per cooler	0–6°C	Note in laboratory narrative; CDM Smith will check packing procedure and increase coolant	CDM Smith FTL	≤6°C
Field Equipment Blank	1 per sampling event	≤ QL	Verify results; reanalyze; flag outliers; check decontamination procedures	Laboratory analyst/CDM Smith SM	≤ QL
Preparation Blank	1 per 20 samples	No constituent > QL	Suspend analysis fix source; redigest and reanalyze affected samples (see laboratory SOP)	Laboratory ICP analyst	No constituent > QL
Matrix Spike	1 per 20 samples/event	75–125%R*	Flag outliers and run postdigestion spike or dilution test	Laboratory ICP analyst	75–125%R*
Laboratory Duplicate or MS	1 per 20 samples	±20% RPD**	Flag outliers	Laboratory ICP analyst	±20% RPD**
Postdigestion Spike	If serial dilution fails criteria	80–120%R	Flag outliers and run dilution test	Laboratory ICP analyst	75–125%R
Serial dilution test (1:5)	1 per batch	Dilution result ±10% of original when original result >10QL	Note chemical or physical interference effect in narrative	Laboratory ICP analyst	Dilution result ±10% of original result
Interference Check Sample	Beginning of run and/or every 12 hours	20% or 50% of true value (see laboratory SOP)	Check calculations and instruments, reanalyze affected samples (see laboratory SOP)	Laboratory ICP analyst	±2xQL of true value or ±20% of true value, whichever is greater
LCS	1 per 20 samples	80–120%R	Rerun once; then redigest and reanalyze affected samples once	Laboratory ICP analyst	80–120%R

* and ** except when the sample concentration is greater than 10x the instrument DL, then disregard the recoveries; no DV action taken
** include ABS criteria
** except when the sample and/or duplicate concentration is less than 5x the CRQL, then ± CRQL

QAPP Worksheet #28f: Analytical Quality Control and Corrective Action (UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous (Total and dissolved)
Analytical Group TAL Inorganic Metals ICP-MS
Analytical Method/SOP Reference EPA 6020A

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples/Field Duplicates	1 per 20 samples	None	Notify SM and address in DQA	CDM Smith ASC and SM	≤50% RPD if both results ≥5QL; ABS ≤ QL when either result <5xQL
Temperature Blank	1 per cooler	0–6°C	Note in laboratory narrative. CDM Smith will check packing procedure and increase coolant	CDM Smith field task leader (FTL)	≤6°C
Field Equipment Blank	1 per sampling event	≤ QL	Verify results; reanalyze. Flag outliers. Check decontamination procedures.	Laboratory analyst/CDM Smith SM	≤ QL
Preparation Blank	1 per 20 samples	No constituent > QL	Suspend analysis fix source; redigest and reanalyze affected samples (see laboratory SOP)	Laboratory ICP analyst	No constituent > QL
Matrix Spike	1 per 20 samples/event	75–125%R	Flag outliers and run postdigestion spike or dilution test	Laboratory ICP analyst	75–125%R
Laboratory Duplicate or MS	1 per 20 samples	±20% RPD*	Flag outliers	Laboratory ICP analyst	±20% RPD*
Postdigestion Spike	If serial dilution fails criteria	80–120%R	Flag outliers and run dilution test	Laboratory ICP analyst	75–125%R
Serial dilution test (1:5)	1 per batch	Dilution result ±10% of original when original result >10x QL	Note chemical or physical interference effect in narrative	Laboratory ICP analyst	Dilution result ±10% of original result
Interference Check Sample	Beginning of run and/or every 12 hours	20% or 50% of true value (see laboratory SOP)	Check calculations and instruments, reanalyze affected samples (see laboratory SOP)	Laboratory ICP analyst	±2x QL of true value or ±20% of true value, whichever is greater
LCS	1 per 20 samples	80–120%R	Rerun once; then redigest and reanalyze affected samples once	Laboratory ICP analyst	80–120%R

*except when the sample and/or duplicate concentration is less than 5x the QL, then ABS $\pm$ QL.

QAPP Worksheet #28g: Analytical Quality Control and Corrective Action (UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Trace Hg (total and dissolved)
Analytical Method/SOP Reference EPA 1631 – Atomic fluorescence spectroscopy

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Split Samples or Field Duplicates	1 per 20 samples	20% RPD	Notify SM and address in data quality report	CDM Smith ASC and SM	≤40% RPD (for results ≥5QL) or ABS ≤ QL
Temperature Blank	1 per cooler	0–6°C	Note in laboratory narrative; CDM Smith will use more coolant; check packing procedure	CDM Smith FTL	≤6°C
Equipment Blank	1 per decontamination event not to exceed 1 per day	≤ QL	Verify results; reanalyze; flag outliers; check decontamination procedures	Laboratory analyst/CDM Smith SM	≤ QL
Preparation Blank	1 per 20 samples	No analyte > QL (greater of 0.4 ng or <0.1x sample)	Suspend analysis; redigest and reanalyze if sample <10x blank result.	Laboratory analyst	No analyte > QL
IPR	1 per 20 samples	Per laboratory SOP	Investigate and correct; Flag outliers; Note in case narrative. Multiple failures require redistillation and reanalysis.		≤20 RSD 80–120%R
Certified Reference Material (QC Sample)	1 per 20 samples or 12-hour shift	Per laboratory SOP	Check calculations and instruments, reanalyze affected samples. Report in case narrative.		Supplier limits
OPR Samples					70–130%R
MS/MSD	2 per 20 samples	Per laboratory SOP	Investigate matrix effects and note in data narrative.		70–130%R RPD ≤25% (30 per method)

QAPP Worksheet #28h: Analytical Quality Control and Corrective Action (UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Wet Chemistry-SSC
Analytical Method/SOP Reference SM 2540D

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Preparation/Method Blank	1 per 20 samples	None	If samples nondetect or if lowest sample result is >10x the blank—no action, otherwise reanalyze and qualify data	Subcontract laboratory	No analyte > QL
Laboratory Duplicate	1/20 or per batch	Per laboratory SOP, ≤20% RPD	Flag outliers	Subcontract laboratory	≤20% RPD; ABS ≤ QL for samples <5x QL
Split Samples	See Worksheet #17 for split samples	None	Data assessor to inform PM if MPC is exceeded; flag results in report	CDM Smith ASC	≤40% RPD if >5xQL, otherwise ABS ≤ QL
Field Duplicates	1 duplicate per 20 samples or per event	None	Data assessor to inform PM if MPC is exceeded; flag results in report	CDM Smith ASC	≤40% RPD if >5xQL, otherwise ABS ≤ QL
Laboratory control sample (LCS) or QC Sample	2 per batch of 20 samples	Average Recovery within the standard manufacture's limits or method limits; <20% RPD	Identify source of problem, reprepare and reanalyze or flag outliers	Subcontract laboratory	80–120%R or as stipulated stipulated by manufacturer or laboratory
LCS or QC Sample Duplicate				Subcontract laboratory	≤20% RPD
Temperature Blank	1 per cooler	0–6°C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	Subcontract laboratory	≤6°C

QAPP Worksheet #28i: Analytical Quality Control and Corrective Action (UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Wet Chemistry-DOC
Analytical Method/SOP Reference EPA 9060A Modified

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank/Calibration Blank	1 per 20 samples	< QL	If samples nondetect or if lowest sample result is >10x the blank—no action, otherwise redigest/reanalyze. Flag results or modify reporting limit.	subcontract laboratory	No analyte > QL
ICV/CCV	1 per batch of 10 samples	85–115%R	Suspend analysis, find cause, and reanalyze associated samples	subcontract laboratory	85–115%R
Laboratory Duplicate	All samples duplicated	≤20% RPD if values >5QL, otherwise ABS ≤5QL	Flag outliers	subcontract laboratory	RPD ≤20% if values >5x QL, otherwise ABS ≤5QL
Matrix Spike	1 per batch of 20 samples	80–120%R	Flag outliers	subcontract laboratory	80-120%R
LCS/QC Sample	1 per batch of 20 samples	80–120%R	Identify source of problem, recalibrate if needed/make other adjustments and reanalyze or flag outliers	subcontract laboratory	80–120%R or as stipulated stipulated by manufacturer or laboratory
LCS or QC Sample Duplicate		RPD ≤20%			RPD ≤20%
Split Samples	See Worksheet #17 for split samples	None	Data assessor to inform PM if MPC is exceeded; flag results in report	CDM Smith ASC	≤40% RPD if results >5x QL, otherwise ABS ≤ QL
Field Duplicates	1 duplicate per 20 samples or per event	None	Data assessor to inform PM if MPC is exceeded; flag results in report	CDM Smith ASC	≤40% RPD if results >5x QL, otherwise ABS ≤ QL
Temperature Blank	1 per cooler	0–6°C	Note outlier in laboratory narrative. Inform CDM Smith of failure/need for additional coolant; check packing steps	subcontract laboratory	≤6°C

QAPP Worksheet #28j: Analytical Quality Control and Corrective Action (UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

Matrix Aqueous
Analytical Group Wet Chemistry-POC
Analytical Method/SOP Reference EPA 9060A Modified

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
Method Blank/Calibration Blank	1 per batch of 20 samples or less	< QL	If samples nondetect or if lowest sample result is >10x the blank—no action, otherwise redigest and reanalyze. Flag results or modify reporting limit.	subcontract laboratory	No analyte > QL
Laboratory Duplicate	All samples duplicated	Per subcontract laboratory SOP	Flag outliers	subcontract laboratory	RPD ≤20 if values >5xQL otherwise ABS ≤ QL
ICV/CCV	ICV – prior to samples; CCV – 1 per batch of 10 samples or every 12 hours	85–115%R	Suspend analysis, find cause, and reanalyze associated samples	subcontract laboratory	90–110%R
LCS/Analytical Quality Control	1 per batch of 20 samples or less	80–120%R or as supplier-certified	Identify source of problem, reprepare and reanalyze or flag outliers	subcontract laboratory	75–125%R or as supplier-certified
LCS/Analytical Quality Control Duplicate		RPD ≤20%			RPD ≤30%
Sample splits	See Worksheet #17 for split samples	None	Data assessor to inform PM if MPC is exceeded; flag results in report	CDM Smith ASC	RPD ≤40% if results >5xQL otherwise ABS ≤ QL
Field Duplicate	1 duplicate per 20 samples or per event	None	Data assessor to inform PM if MPC is exceeded; flag results in report	CDM Smith ASC	RPD ≤40% if results >5xQL otherwise ABS ≤ QL
Temperature Blank	1 per cooler	0–6°C	Note outlier in laboratory narrative. Inform CDM Smith of failure and need for additional coolant; check packing procedure	subcontract laboratory	≤6°C

QAPP Worksheet #28k: Analytical Quality Control and Corrective Action (UFP-QAPP Manual Section 3.4 and Tables 4, 5, and 6) (EPA 2106-G-05 Section 2.3.5)

PROCEDURE FOR QC SAMPLE COLLECTION

Duplicates:
Field duplicate samples are collected and analyzed to assess the overall precision of the field sampling technique. Duplicate samples, of the same matrix, will be collected at a rate of one per event, with a total of 12 events taking place. These duplicates will be submitted "blind" to the laboratories by using sample numbers that differ from their associated environmental samples. For groundwater samples collected during the sampling event, duplicate samples will be collected on a per-event basis.

Duplicate samples will be collected by alternately filling bottles for the same analysis.

Cooler temperature indicators:
One cooler temperature indicator (temperature blank) will be placed in each cooler containing samples (solid and aqueous) being sent to the laboratory for analysis. The temperature blank will consist of a sample container filled with nonpreserved water (potable or distilled). The container will be labeled "COOLER TEMPERATURE INDICATOR" and dated.

Matrix spikes:
MSs are laboratory QC samples drawn from excess volumes of existing samples to demonstrate the accuracy of laboratory analysis. In accordance with EPA Region 2, matrix spikes will be designated on environmental samples at a rate of one per sample delivery group (SDG). This designation will be noted on the sample container labels and the sample paperwork. An SDG is defined as one of the following:

1. All samples of an analytical case, if the sample number is less than 20 (including environmental duplicates and QC blanks) and if sampling is completed within 7 calendar days.
2. Each group of 20 samples within an analytical case (including environmental duplicates but excluding QC blanks) if the number is greater than 20.
3. Each 7-day calendar day period during which samples within an analytical case are received. This period begins with the receipt of the first sample in the SDG.

Triple volume may be required for aqueous volatile organic compound (VOC) matrix MS/MSD if a subcontract laboratory is being used and are not required for CLP method SOM02.4. EPA's LSASD laboratory requires triple volume for aqueous VOC samples. The water quality parameters may require extra volume, as identified on Worksheet #19 and confirmed with a non-CLP laboratory.

QAPP Worksheet #29: Project Documents and Records
(UFP-QAPP Manual Section 3.5.1)
(EPA 2106-G-05 Section 2.2.8)

Record[1]	Organics	Metals	Wet Chemistry
Narrative	X	X	X
COC	X	X	X
Summary Results	X	X	X
Analytical sample results	X	X	X
QC Results	X	X	X
Chromatograms	X	NA	NA[2]
Sample Preparation Log	X	X	X
Sample Run Log	X	X	X
Raw Data	X	X	X

[1] The records indicated are as-applicable to the oversight effort.
[2] Chromatograms are not applicable for analysis of SSC, POC, and DOC.

QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action (UFP-QAPP Manual Sections 4.1.1 and 4.1.2) (EPA 2106-G-05 Section 2.4 and 2.5.5)

Assessment Type	Number/Frequency	Organization	Responsible Party	Assessment Deliverable and Due Dates	Party to Identify and Implement Corrective Actions	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions
					Title and Organizational Affiliation	
Project Readiness Review	Prior to field work	CDM Smith	FTL	Immediately; to within 24 hours of review	TM or PM, CDM Smith	PM, CDM Smith
Sample Collection and Documentation	Once	CDM Smith	FTL	E-mail within 24 hours	TM or PM, CDM Smith	Jeniffer Oxford (QAS) or field auditor, CDM Smith
QAPP	Annually	CDM Smith	Approved CDM Smith QA staff	E-mail if required	TM, CDM Smith	PM, CDM Smith
Data Review	Once	CDM Smith	ASC or designee	Memorandum based on project requirements	Project Chemist, FTL, or PM depending on nature of issue	PM, CDM Smith

[1] The CDM Smith QAM will determine the need for any field or office audits. If self-assessments are requested in lieu of a project audit, the QAM will review/approve/reject the request.

[2] Field auditors are selected based on level of experience and technical specialty. Office audits are performed by trained and approved QA staff members. Oversight projects typically have a series of self-assessments at the discretion of the QAM.

[3] Deviations from plans will require corrective actions that will be documented and discussed appropriately. The EPA RPM and the USACE PM will be notified by the PM.

QAPP Worksheet #34: Data Verification and Validation Inputs
(UFP-QAPP Manual Section 5.2.1 and Table 9)
(EPA 2106-G-05 Section 2.5.1)

Item	Input	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records				
1	QAPP	All planning documents will be available to reviewers to allow reconciliation with planned activities and objectives.	**X**	**X**
2	Field SOPs		**X**	**X**
3	Laboratory SOPs		**X**	**X**
Field Records				
4	Field logbooks	Field notes will be prepared daily by the field team and will be complete, appropriate to the project tasks, and legible. The FTL will review logbooks and records for accuracy and completeness. Upon completion of field work, logbooks and records will be placed in the project files. Field reports will be verified to ensure correct reporting of information. Review will be conducted prior to completion of each report.	X	X
5	COC	Sample manager, FTL or designee will review the COC forms against the samples packed in each cooler prior to shipment. COCs will be sent with the samples to the laboratory and copies retained for the Trip Report and project files. The data validator will be review upon completion of analytical activities and verified against the laboratory report.	X	X
6	Correspondence	Relevant correspondence will be used to reconcile field records and data.	X	X
7	Field change request	CDM Smith ASC and data evaluator will review during completion of each data usability assessment.	X	X

QAPP Worksheet #34: Data Verification and Validation Inputs
(UFP-QAPP Manual Section 5.2.1 and Table 9)
(EPA 2106-G-05 Section 2.5.1)

Item	Input	Description	Verification (completeness)	Validation (conformance to specifications)
Analytical Data Package				
8	Laboratory analytical data packages	Laboratory analyst and QA officer will review/verify internally the completeness and technical accuracy of data prior to submittal. All laboratory data will be verified by the laboratory performing the analysis prior to submittal. CDM Smith data validator will review data packages for content and sample information upon receipt. Data packages will be evaluated for completeness and compliance. Table 9 of the Intergovernmental Data Quality Task Force UFP-QAPP shows items for compliance review.	X	X
9	Communication records	Relevant correspondence will be used to reconcile analytical data.	X	X
10	Field EDDs	Data manager will determine whether required EQuIS-compatible EDD fields and format were provided.	X	X
11	Outputs of the EQuIS database	Project task leader and team will compile the project data results in a sample project report. Data tables, figures, and reported entries will be reviewed/verified against hardcopy information or EQuIS output.	X	X
12	DV and audit reports, QAPP, and FCNs	Data assessor will prepare the project data quality and usability assessment report. The data will be evaluated against project DQOs and measurement performance criteria, such as completeness. Evaluate whether field sampling procedures were followed with respect to equipment and proper sampling support.	X	X

QAPP Worksheet #35: Data Verification Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

Requirement Documents	Records Reviewed	Process Description	Responsible Person/Organization
QAPP, Technical SOP 4-1	Field logbook	Verify that records are present and complete for each day of field activities. Verify that all planned samples including field QC samples were collected and that sample collection locations are documented. Verify that meteorological data were provided for each day of field activities. Verify that changes/exceptions are documented and were reported in accordance with requirements. Verify that any required field monitoring was performed and results are documented.	Daily: FTL and At conclusion of field activities: project QC staff
SOPs	Field logbook and FCNs	Ensure that the sampling methods/procedures outlined in QAPP were followed, and that any deviations were noted/approved. Determine potential impacts from noted/approved deviations with regard to project quality objectives (PQOs).	CDM Smith TM or ASC
QAPP, Technical SOP 1-2	COC forms	Verify the completeness of COC records. Examine entries for consistency with the field logbook. Check that appropriate methods and sample preservation have been recorded. Verify that the required volume of sample has been collected and that sufficient sample volume is available for QC samples (e.g., MS/MSD). Verify that all required signatures and dates are present. Check for transcription errors.	Daily: FTL At conclusion of field activities: project chemist or data assessor
QAPP, Technical SOP 1-2	COC	Examine traceability of data from sample collection to generation of project reported data. Provides sampling dates and time, verification of sample ID, and QC sample information.	At conclusion of field activities: project QC staff (data coordinator, data validator)
QAPP	Laboratory data package	Examine packages against QAPP and laboratory contract requirements, and against COC forms (e.g., holding times, sample handling, analytical methods, sample ID, data qualifiers, QC samples, etc.). Determine potential impacts from noted/approved deviations with regard to PQOs.	Environmental Services Assistance Team DV personnel, EPA Region 2 or CDM Smith data validator

QAPP Worksheet #35: Data Verification Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

Requirement Documents	Records Reviewed	Process Description	Responsible Person/Organization
QAPP	Laboratory deliverable	Verify that the laboratory deliverable contains all records specified in the subcontract SOW. Check sample receipt records to ensure sample condition upon receipt was noted, and any missing/broken sample containers were noted and reported according to plan. Compare the data package with the COCs to verify that results were provided for all collected samples. Review the narrative to ensure all QC exceptions are described. Check for evidence that any required notifications were provided to project personnel as specified in the QAPP. Verify that necessary signatures and dates are present.	Before release: laboratory QAM Upon receipt: project chemist or data validator (CDM Smith DV personnel or ASC)
	Field duplicates	Compare results of field duplicate (or replicate) analyses with RPD criteria.	CDM Smith ASC, data validator, or data assessor
	Methods	Verify that records support implementation of the SOPs for sampling and analysis.	
	Data narrative	Determine deviations from methods and contract and the impact.	
	Audit report	Confirm reports are used to validate compliance of field sampling, handling, and analysis activities with the QAPP.	
	Field and laboratory data and QC report	A summary of all QC samples and results will be verified for MPC (e.g., completeness) and 10% will be verified to field and laboratory data reports from vendors. A report describing adherence to established criteria shall be prepared within 30 days of data receipt.	

QAPP Worksheet #36: Data Validation Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

Analytical Group/Method	Data deliverable requirements	Analytical specifications	Measurement performance criteria	% of data packages to be validated [1]	% raw data review/% results to recalculate	Validation Procedure[2]	Validation code	Electronic validation program/version	Data Validator
FASTAC Tier 4 (CDM Smith Subcontract Laboratory]									
TAL Metals (ICP-AES)	EQuIS Region 2-compliant EDD	Worksheet #28, SW-846, 6010B/C	Worksheets #12 and 28	100%	0%/10%	National Functional Guidelines or available EPA Region 2 SOPs, modified by Worksheets #12 ,15, 19, and 24	S3VM	NA	CDM Smith
TAL Metals (ICP-MS)		Worksheet #28, 6020							
PAHs, Pesticides		Worksheet #28, SW-846, 1699, 8270D							
PCB Congeners		Worksheet #28 and EPA 1668A							
Dioxin/Furans		Worksheet #28 and EPA 1613B (Isotope dilution)							
Trace Hg		Worksheet #28 and EPA 1631							
DOC, POC, and SSC		Worksheet #28 and methods							

Notes:
1. No streamlining of the DV procedures are required. The percentage of packages validated or level of validation may be reduced based on laboratory performance.
2. Method requirements will be used to evaluate the data during DV.

QAPP Worksheet #36: Data Validation Procedures
(UFP-QAPP Manual Section 5.2.2)
(EPA 2106-G-05 Section 2.5.1)

Validation Code and Label Identifier Table

Validation Code*	Validation Label	Description/Reference	
S1VE	Stage 1 Validation Electronic	Stage 1 Validation – Verification and validation based only on completeness and compliance of sample receipt condition checks.	EPA 540-R-08-005
S1VM	Stage 1 Validation Manual		
S1VEM	Stage 1 Validation Electronic and Manual		
S2aVE	Stage 2a Validation Electronic	Stage 2A Validation – Verification and validation based on completeness and compliance checks of sample receipt conditions and ONLY sample-related QC results.	
S2aVM	Stage 2a Validation Manual		
S2aVEM	Stage 2a Validation Electronic and Manual		
S2bVE	Stage 2b Validation Electronic	Stage 2B Validation – Verification and validation based on completeness and compliance checks of sample receipt conditions and BOTH sample-related and instrument-related QC results.	
S2bVM	Stage 2b Validation Manual		
S2bVEM	Stage 2b Validation Electronic and Manual		
S3VE	Stage 3 Validation Electronic	Stage 3 Validation – Verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, AND recalculation checks.	
S3VM	Stage 3 Validation Manual		
S3VEM	Stage 3 Validation Electronic and Manual		
S4VE	Stage 4 Validation Electronic	Stage 4 Validation – Verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, recalculation checks, AND the review of actual instrument outputs.	
S4VM	Stage 4 Validation Manual		
S4VEM	Stage 4 Validation Electronic and Manual		
NV	Not Validated		

The following data qualifiers will be applied during DV by a third party; potential impacts on project DQOs will be discussed in the DV report:
NM – The MPCs contained in Worksheet #12 were not met.
J – The result is an estimated value. The nature of the bias will be discussed in the DV report.
E – Erroneous result (e.g., improper calculation, peak integration, etc.).
R – The results has been rejected by the validator.
U – The result is identified as not detected at the concentration level listed.

QAPP Worksheet #37: Data Usability Assessment
(UFP-QAPP Manual Section 5.2.3 including Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

The data usability assessment process will be summarized to include statistics, equations, and computer algorithms used to analyze the data:

Step 1	**Review the project's objectives and sampling design** Review the key outputs defined during systematic planning (i.e., PQOs or DQOs and MPCs) to make sure they are still applicable. Review the sampling design for consistency with stated objectives. This provides the context for interpreting the data in subsequent steps.
Step 2	**Review the data verification and DV outputs** Review available QA reports, including the data verification and DV reports. Perform basic calculations and summarize the data (using graphs, maps, tables, etc.). Look for patterns, trends, and anomalies (i.e., unexpected results). Review deviations from planned activities (e.g., number and locations of samples, holding time exceedances, damaged samples, noncompliant performance testing sample results, and SOP deviations) and determine their impacts on the data usability. Evaluate implications of unacceptable QC sample results.
Step 3	**Verify the assumptions of the selected statistical method** Verify whether underlying assumptions for selected statistical methods (if documented in the QAPP) are valid. Common assumptions include the distributional form of the data, data independence, dispersion characteristics, homogeneity, etc. Depending on the robustness of the statistical method, minor deviations from assumptions are usually not critical to statistical analysis and data interpretation. If serious deviations from assumptions are discovered, then another statistical method may need to be selected.
Step 4	**Implement the statistical method** Implement the specified statistical procedures for analyzing the data and review underlying assumptions. For decision projects that involve hypothesis testing (e.g., "concentrations of lead in groundwater are below the action level") consider the consequences for selecting the incorrect alternative; for estimation projects (e.g., establishing a boundary for surface soil contamination), consider the tolerance for uncertainty in measurements.
Step 5	**Document data usability and draw conclusions** Determine if the data can be used as intended, considering implications of deviations and corrective actions. Discuss DQIs. Assess the performance of the sampling design and identify limitations on data use. Update the conceptual site model and document conclusions. Prepare the data usability summary report in the form of text and/or a table.

QAPP Worksheet #37: Data Usability Assessment
(UFP-QAPP Manual Section 5.2.3 including Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

Personnel (organization and position/title) responsible for participating in the data usability assessment: CDM Smith TM, CDM Smith DC.

The usability assessment will be documented as follows:
The oversight report will be prepared by CDM Smith personnel, including the TM and DC. The TM will be responsible for preparation of the oversight report and for assigning work to the CDM Smith personnel who will be supporting the assessment, data comparability review, and usability assessment that will be conducted on validated data. The effectiveness of control actions will be evaluated during the laboratory review of the data and the DV, data evaluation, and DQA process. Data information will be documented in the laboratory narrative, data usability assessment report, and oversight report. The report will include an overall assessment of the CPG's analytical data using the results of the split sampling and field oversight, including the field oversight observations of deficiencies and compliance, and an assessment of the split sampling data quality. The following items will be assessed for CDM Smith split samples and conclusions drawn based on their results:

Precision – Split samples will be compared by matrix using the RPD for each pair of results reported above QLs and presented graphically as bivariate scatter plots relative to a 1:1 line and on a table. As appropriate, alternative data comparisons will be used. For each mooring location, a mean and variance of the suspended solids (1.5 µm filter) sample. POC (0.7 µm filter) and suspended solids (0.7 µm filter) split sample data will be combined to estimate the carbon load on suspended solids greater than 0.7 µm. This carbon load will be compared to the available CPG data. If needed, other statistical determination may be conducted. Additional information on data handling is included on Worksheet #11.

Results of laboratory duplicates will be assessed during DV, and data will be qualified according to the DV procedures cited on Worksheet #36. RPD acceptance criteria less than or equal to those in this QAPP will be used to assess sampling precision. Absolute difference will be used when one or both results are at or below the QL. An absolute difference of less than five times the QL will be the acceptance criteria. A discussion summarizing the results of laboratory precision and any limitations on the use of the data will be described in the report.

Accuracy/Bias Contamination – Results for all laboratory blanks will be assessed as part of the DV. During the validation process, the validator will qualify the data following the procedures described in Worksheet #36. A discussion summarizing the results of laboratory accuracy and bias based on contamination will be presented and any limitations on the use of the data will be described in the report.

Overall Accuracy/Bias – The results of instrument calibration and matrix spike recoveries will be reviewed and data will be qualified according to the DV procedures cited on Worksheet #36. A discussion summarizing the results of laboratory accuracy and any limitations on the use of the data will be described.

QAPP Worksheet #37: Data Usability Assessment
(UFP-QAPP Manual Section 5.2.3 including Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

Sensitivity – Data results will be compared to criteria provided on Worksheet #15. A discussion summarizing any conclusions about sensitivity of the analyses will be presented, and any limitations on the use of the data will be described in the report.

Representativeness – A review of adherence to the sampling plan, field procedures, and project QA audits will be performed in order to assess the representativeness of the sampling program. DV narratives also will be reviewed, and any conclusions about the representativeness of the data set will be discussed.

Comparability – The results of this study will be used in conjunction with the CPG's data to support the investigation results. The data will be collected, analyzed, and reported in a manner that is comparable to the CPG's data set. The RPD between CDM Smith's and the CPG's data will be calculated.

Completeness – A completeness check will be done on the analytical data generated by the laboratories. Completeness will be calculated for each analyte and compared to the project completeness goal of 90%. For sampling, completeness will be calculated as the number of samples collected and analyzed divided by the number of samples planned for collection. For each analyte, completeness will also be calculated as the number of data points that meet measurement performance criteria divided by the total number of data points for that analyte. A discussion summarizing the results of project completeness and any limitations on the use of the data will be described in the report.

Reconciliation – The DQIs presented in Worksheet #12 will be examined to determine if the MPCs were met. This examination will include a combined overall assessment of the results of each analysis pertinent to an objective. Each analysis will first be evaluated separately in terms of major impacts observed from DV, DQIs, and measurement performance criteria assessments. Based on the results of these assessments, the quality of the data will be determined. As a result of the quality determined, the usability of the data for each analysis will be established. After the combined usability of the data from all analyses for an objective is determined, it will be concluded if the DQIs were met and whether project goals were achieved. As part of the reconciliation of each objective, conclusions will be drawn and any limitations on the usability of any of the data will be described.

DV reports will be reviewed to determine the quality of the data and potential impacts on data usability. Field duplicates will be evaluated against the MPCs outlined in worksheet #12. Noncompliant data will be discussed in the usability report. The following equations will be used:

QAPP Worksheet #37: Data Usability Assessment
(UFP-QAPP Manual Section 5.2.3 including Table 12)
(EPA 2106-G-05 Section 2.5.2, 2.5.3, and 2.5.4)

1. To calculate field duplicate precision:

RPD = 100 × 2 |X1 − X2 |/(X1 + X2), where X1 and X2 are the reported concentrations for each duplicate or replicate

2. To calculate completeness:

% Completeness = V/n × 100, where V= number of measurements judged valid; n = total number of measurements made and
% Completeness = C/X × 100, where C= number of samples collected; X = total number of measurements planned

The results will be evaluated using temporal and spatial relationships of the data. This activity will be performed during the data usability evaluation and oversight reporting. Not all "J" qualified data are usable, so all lines of evidence to support data use will be evaluated. Although "J" data are reasonable for use, CDM Smith will document the evaluation of all qualified results against the values, data quality, and bias of surrounding data. If needed, qualified results at plume edges will be mapped and evaluated. Validated results will be further examined during data evaluation and recoded in accordance with EPA Region 2 directives.

For qualified results that are outliers or at the edge of contaminated areas:

a) Discuss how data outliers will be addressed
b) Evaluate against all issues such as geology, hydrogeology, depth, past history
c) Consider whether qualified data are reasonable based on surrounding data (e.g., data qualified due to missed holding time may be lower than we expect)
d) Address data quality bias and reason for qualification
e) Evaluate effect of data qualification on the data

The investigation results will be presented in tables and figures and in the text of the oversight report. Data gaps will be evaluated if requested by USACE or EPA. The report will discuss the completeness of the planned and collected data and the effect on the data objective of evaluating the accuracy of the CPG's data.